NOTICE

All drawings located at the end of the document.

Technical Services to Assist in

Mixed Radioactive/Hazardous and Geotechnical Waste Management Services at the Rocky Flats Plant

EBASCO

In association with

DAMES & MOORE

SAIC

S.M. Stoller Corporation

Prepared for:

EG&G ROCKY FLATS

TECHNICAL SERVICES
TO ASSIST IN MIXED RADIOACTIVE/HAZARDOUS AND GEOTECHNICAL WASTE MANAGEMENT SERVICES FOR THE DEPARTMENT OF ENERGY AT THE ROCKY FLATS PLANT

PHASE I RFI/RI DRAFT WORK PLAN FOR OPERABLE UNIT 3 OTHER OUTSIDE CLOSURES

June 22, 1990

Prepared by:

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EG&G ROCKY FLATS, INC.
AGREEMENT NO. BA 56800PB
WORK ORDER NO. BA 68157EB

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TABLE OF CONTENTS

TABLE OF CONTENTS
(continued)

Section | Page

TABLE OF CONTENTS
(continued)

TABLE OF CONTENTS
(continued)

TABLE OF CONTENTS
(continued)

Section | Page

TABLE OF CONTENTS
(continued)

Section	Page

TABLE OF CONTENTS
(continued)

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS AND ACRONYMS

AEC	Atomic Energy Commission
ARAR	Applicable or relevant and appropriate requirement
BRAP	Baseline Risk Assessment Plan
CAD/ROD	Corrective Action Decision/Record of Decision
CDH	Colorado Department of Health
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLP	Contract Laboratory Program
cm	Centimeter
CMS/FS	Corrective Measure Study/Feasibility Study
cpm	Counts per minute
CRP	Community Relations Plan
DOE	Department of Energy
DQOs	Data Quality Objectives
DRCOG	Denver Regional Council of Governments
EBASCO	Ebasco Services Incorporated
EEP	Environmental Evaluation Program
EPA	Environmental Protection Agency
ER	Environmental Restoration
ERDA	Energy Research and Development Administration
FIDLER	Field Instrument for Detection of Low Energy Radiation
ft	Foot/feet
FOL	Field Operations Leader
FSP	Field Sampling Plan
FQAC	Field Quality Assurance Coordinator
gpd	gallons per day
HSL	Hazardous Substance List
HSO	Health and Safety Officer
HSP	Health and Safety Plan
IAG	Interagency Agreement
IM/IRA	Interim Measure/Interim Remedial Action
mg/kg	Milligrams per kilogram
mg/L	Milligrams per liter
msl	Mean sea level
NEPA	National Environmental Policy Act
No	Number
NPDES	National Pollutant Discharge Elimination System
NRC	Nuclear Regulatory Commission
OU	Operable Unit
OSWER	Office of Solid Waste and Emergency Response
pCi/L	picocuries per liter
PCB	Polychlorinated biphenyl
QA	Quality assurance
QC	Quality control
QAPP	Quality Assurance Project Plan

LIST OF ABBREVIATIONS AND ACRONYMS

RCRA	Resource Conservation and Recovery Act
RFI/RI	RCRA Facility Investigation/Remedial Investigation
SAP	Sampling and Analysis Plan
SOP	Standard Operating Procedures
SOW	Statement of Work
SWMU	Solid Waste Management Unit
TCL	Target Compound List
TRU	Transuranic
USGS	U.S. Geologic Survey

1.0 INTRODUCTION

1.1 OVERVIEW

Ebasco Services Incorporated (EBASCO) and Dames and Moore have prepared this Work Plan for the Phase I Resource Conservation and Recovery Act (RCRA) Facility Investigation/Remedial Investigation (RFI/RI) for the Operable Unit (OU) 3 Other Outside Closures. This Work Plan and attached Field Sampling Plan (FSP), Baseline Risk Assessment Plan (BRAP), and Environmental Evaluation Plan (EEP), were prepared in accordance with CERCLA, the National Oil and Hazardous Substance Pollution Contingency Plan (NCP), RCRA, NEPA, and applicable Colorado State Law. The presented Work Plan is prepared to be consistent with the Interagency Agreement (IAG) between the DOE, the EPA, and the State of Colorado and the following guidance documents where applicable:

- EPA, Compendium of Superfund Field Operation Methods, September 1987
- EPA, Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA: OSWER Directive 9355.3-01, October 1988
- EPA, RCRA Facility Investigation Guidance, Interim Final, May 1989
- EPA, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, SW-846, October 1986
- EPA, Interim Final Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual: OSWER Directive 9285.701A, July 1989
- EPA, Interim Final Risk Assessment Guidance for Superfund Volume II: Environmental Evaluation Manual: EPA/540/1-89/001, March 1989
- EPA, Superfund Public Health Evaluation Manual, October 1986
- EPA, Environmental Evaluation Manual, Interim Final, March 1989.

The background portion of the Work Plan includes a summary of existing data, a conceptual site model, a description of investigation and management strategies developed during scoping, preliminary identification of possible remedial alternatives, plans for each RI/FS task, and project management approach.

The FSP describes the sampling program necessary to determine nature and extent of contamination, provide data for remedial alternatives evaluation, provide data for the baseline risk assessment, and provide data for the environmental evaluation. The FSP describes sampling objectives, sampling locations and frequencies, sample designation, sampling equipment and procedures, and sample handling and analysis.

The BRAP specifies the techniques and methodology necessary to identify and characterize the toxicity and levels of all hazardous substances present, contaminant fate and transport, the potential for human and/or environmental exposure, or both, and the risk of potential impacts or threats on human health and the environment. The Baseline Risk Assessment provide the basis for determining whether or not Corrective/Remedial Action is necessary, and justification for performing Corrective/Remedial Actions. The BRAP includes the following components:

1) Contaminant Identification
2) Exposure Assessment
3) Toxicity Assessment, and
4) Risk Characterization.

The EEP specifies the information necessary to adequately characterize the nature and extent of environmental risk or threat resulting from each site and the Operable Unit (OU). This Work Plan demonstrates how the environmental evaluation addresses:

1) critical habitats affected by site contamination

2) endangered species or habitats of endangered species affected by the contamination

3) Incorporation of characterization (soils) and contaminant source data as appropriate to address items (1) and (2). This includes a description of pre-existing data and needs for additional data as described in the FSP.

1.2 RFI/RI OBJECTIVES

The objectives of the Phase I RFI/RI are to characterize the nature and extent of soil contamination at sites comprising OU 3 Other Outside Closures. The Phase I RFI/RI will be conducted in accordance with the Guidance for Conducting Remedial Investigations and

Feasibility Studies under CERCLA (EPA, 1988b) and Interim Final RCRA Facility Investigation (RFI) Guidance (EPA, 1989b). The data generated will be used to begin developing and screening remedial alternatives and to evaluate the need for the performance of treatability studies. The data will also be available for the determination of risks to human health or the environment posed by each hazardous substance.

1.3 WORK PLAN ORGANIZATION

This Phase I RFI/RI for OU 3 Other Outside Closures will characterize soils and sources of contamination for sites comprising OU 3 Other Outside Closures. Section 2.0 describes the site background and environmental setting for the Rocky Flats Plant. Section 3.0 gives the location, description, history, previous investigations, and conceptual models for 13 Solid Waste Management Units (SWMUs) contained in OU 3. Section 3.0 also outlines preliminary remedial action alternatives. Section 5.0 discusses 13 remediation tasks consisting of project planning, community relations, field investigations, sample analysis/validation, data evaluation, risk assessment, treatability studies, Phase I RFI/RI Report, Phase I IM/IRA, Phase II RFI/RI, Phase II CMS/FS, remedy selection, and final action implementation. Section 5.0 discusses RFI/RI Tasks. Section 6.0 contains project management and Section 7.0 contains references.

Three appendices are attached to this Work Plan which include the FSP, BRAP, and EEP located in Appendices A, B, and C respectively.

2.0 SITE BACKGROUND AND SETTING

2.1 FACILITY BACKGROUND

2.1.1 Facility History

The information contained in Section 2.0 is summarized from the Rocky Flats Plant Site Environmental Report for 1988 (Rockwell International, 1989c) and the Phase III RI/FS Draft Work Plan for the Rocky Flats Plant 881 Hillside Area (Department of Energy (DOE), 1990). The DOE's Rocky Flats Plant is located in northern Jefferson County, Colorado, approximately 16 miles northwest of Denver (Figure 2-1). The Plant consists of approximately 6,550 acres of Federally owned land in Sections 1 through 4 and 9 through 15 of T2S, R70W, 6th Principal Meridian. Major buildings are located within the Plant security area of approximately 400 acres. The security area is surrounded by a buffer zone of approximately 6,150 acres.

The Rocky Flats Plant is a government-owned, contractor-operated facility which is part of the nationwide nuclear weapons production complex. The Plant was operated for the U.S. Atomic Energy Commission (AEC) from its inception in 1951, until the AEC was dissolved in January 1975. At that time, responsibility for the Plant was assigned to the Energy Research and Development Administration (ERDA), which was succeeded by the DOE in 1977. Dow Chemical U.S.A., an operating unit of the Dow Chemical Company, was the prime operating contractor of the facility from 1951 until June 30, 1975. Rockwell International was the prime contractor responsible for operating the Rocky Flats Plant from July 1, 1975, until December 31, 1989. EG&G Rocky Flats, Inc., became the prime contractor at the Plant on January 1, 1990.

2.1.2 Facility Description

The primary plant mission is to produce components for nuclear weapons. Plutonium, uranium, beryllium, and stainless steel parts are fabricated at the Plant and shipped off-site for final assembly. Additional activities include chemical processing to recover plutonium from scrap material, metallurgical research and development, machining, assembly, nondestructive testing, coating remote engineering, chemistry, and physics. Waste handling operations at the Rocky Flats Plant include storage, transport, treatment, and packaging of

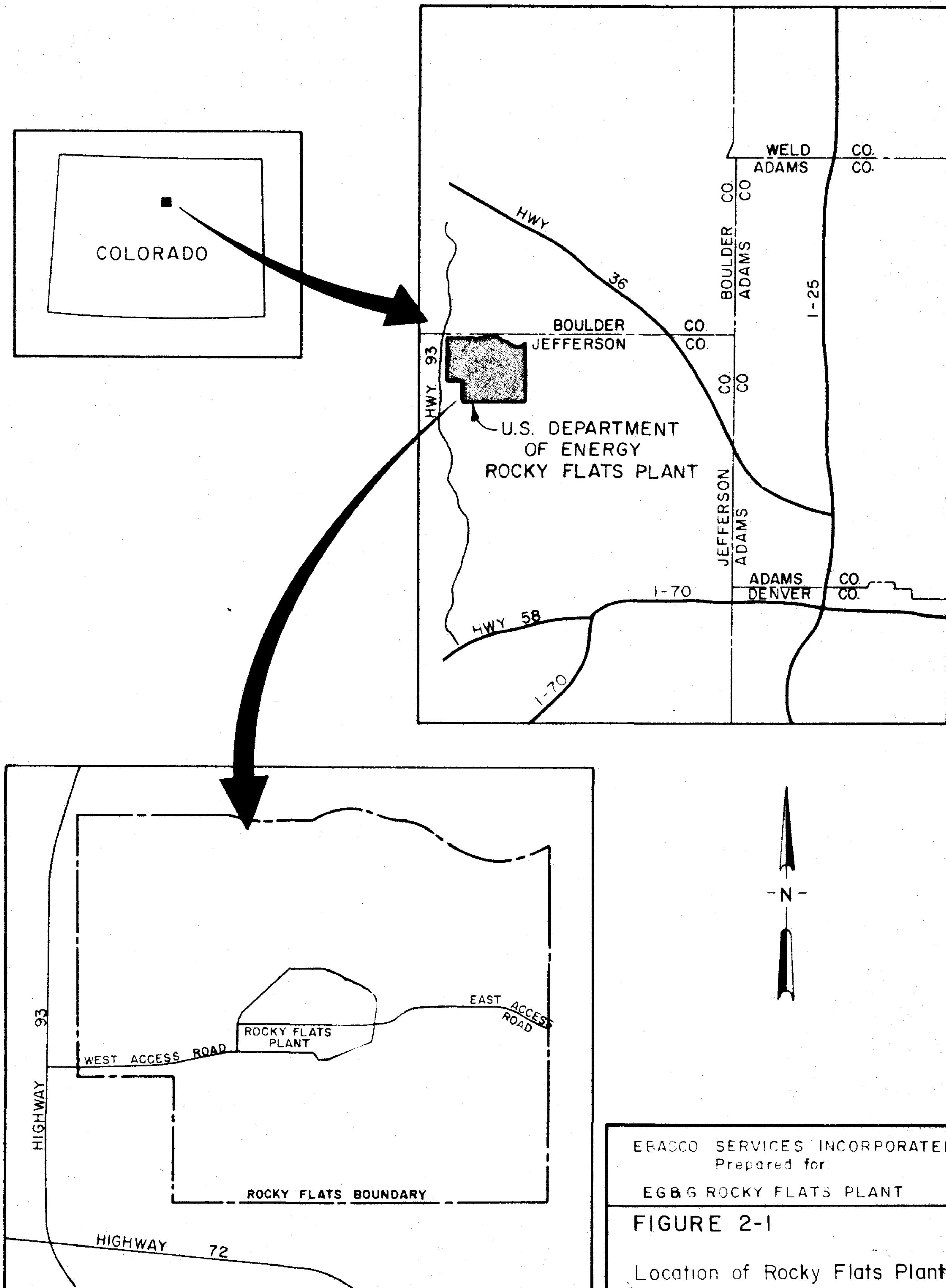

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FIGURE 2-1

Location of Rocky Flats Plant

waste materials generated on-site. The waste forms that are handled include hazardous chemical waste, transuranic (TRU) waste, nonhazardous and nonradioactive waste, and combinations thereof. Current waste handling practices involve on-site and off-site recycling of hazardous materials, on-site storage of hazardous and radioactive mixed wastes, and off-site disposal of solid radioactive materials at another DOE facility. However, both storage and disposal of hazardous and radioactive wastes occurred on-site in the past. Preliminary assessments under the Environmental Restoration (ER) Program identified some of the past on-site storage and disposal locations as potential sources of environmental contamination.

Approximately 140 structures on the site contain approximately 256,400 square meters (2.76 million square feet (ft)) of floor space. Of this space, major manufacturing, chemical processing, plutonium recovery, and waste treatment facilities occupy about 148,600 square meters (1.6 million square ft). The remaining floor space is divided among laboratory, administrative, utility, security, warehouse, storage, and construction contractor facilities, and occupies about 107,800 square meters (1.16 million square ft).

2.2 ENVIRONMENTAL SETTING

2.2.1 Demographic Factors and Land Use

The Rocky Flats Plant is located in a rural area. Approximately 50 percent of the area within ten miles of the Rocky Flats Plant is in Jefferson County. The remainder is located in Boulder County (40 percent) and Adams County (10 percent). According to the 1973 Colorado Land Use Map, 75 percent of this land was unused or was used for agriculture. Since that time, portions of this land have been converted to housing, with several new housing subdivisions being constructed within a few miles of the buffer zone. One such subdivision is located south of the Jefferson County Airport and several are located southeast of the Plant.

A demographic study using 1980 census data shows that approximately 1.8 million people lived within 50 miles of the Rocky Flats Plant. Approximately 9,500 people lived within 5 miles of the Plant. The most populous sector was to the southeast, toward the center of

Denver. This sector had a 1980 population of about 555,000 people living between 10 and 50 miles from Rocky Flats. Recent population estimates registered by the Denver Regional Council of Governments (DRCOG) for the eight county Denver metro region have shown distinct patterns of growth between the first and second halves of the decade. Between 1980 and 1985, the population of the eight county region increased by 197,890, a 2.4 percent annual growth rate. Between 1985 and 1989 a population gain of 71,575 was recorded, representing a 1.0 percent annual increase (the national average). The 1989 population showed an increase of 2,225 (or 0.1 percent) from the same date in 1988.

There are eight public schools within 6 miles of the Rocky Flats Plant. The nearest educational facility is the Witt Elementary School, which is approximately 2.7 miles east of the Plant buffer zone. The closest hospital is Centennial Peaks Hospital located approximately 7 miles northeast. The closest park and recreation area is the Standley Lake area, which is approximately 5 miles southeast of the Plant. Boating, picnicking, and limited overnight camping are permitted. Several other small parks exist in communities within 10 miles. The closest major park, Golden Gate Canyon State Park, located approximately 15 miles to the southwest, provides 8,400 acres of general camping and outdoor recreation. Other recreation areas, including a national park, are located in the mountains west of the Rocky Flats Plant, however, all are in excess of 15 miles away from the facility.

A portion of the land adjacent to the Plant is zoned for industrial development. Industrial facilities within 5 miles of Rocky Flats include the 40-acre TOSCO laboratory, located 2 miles to the south, the Great Western Inorganics Plant, located 2 miles to the south, the Frontier Forest Products yard, located 2 miles to the south, the Idealite Lightweight Aggregate Plant, located 2.4 miles to the northwest, and the 990-acre Jefferson County Airport and Industrial Park, located 4.8 miles to the northeast.

Several ranches are located within 10 miles of the Plant, primarily in Jefferson and Boulder Counties, which produce crops, milk, and raise beef cattle, and which breed and train horses. According to the 1987 Colorado Agricultural Statistics, 20,758 acres of crops were planted in Jefferson County (total land area of approximately 475,000 acres) and 68,760 acres of crops were planted in Boulder County (total land area of 405,760 acres). Crops consisted of winter wheat, corn, barley, dry beans, sugar beets, hay, and oats. Livestock in Jefferson County consisted of 5,314 head of cattle, 113 hogs, and 346 sheep in Jefferson County, while 19,578 head of cattle, 2,216 hogs, and 12,133 sheep were reported in Boulder County.

2.2.2 Climate

The Rocky Flats Plant is located in a region of semiarid climate, characterized by warm summers and dry, cool winters, with some snow cover, as it is typical of much of the central Rocky Mountain Region. Considerable clear-sky sunshine, and low average precipitation and relative humidity are also indicative of this vicinity. The elevation of the Plant and the major topographical features in the area significantly influence the climatological and meteorological dispersion characteristics of the site. Winds, although variable, are predominantly northwesterly at Rocky Flats, with strongest winds occuring during the winter. Studies of air flow and dispersion characteristics indicate that winds coming down off the mountains to the west turn and move toward the north and northeast along the South Platte River valley, and pass to the west and north of Brighton, Colorado.

Approximately 40 percent of the typical 15-inch annual precipitation falls during the spring season, predominantly as wet snow. Thunderstorms, occurring from June to August, account for an additional 30 percent of the annual precipitation. Drier autumn and winter seasons account for 19 and 11 percent of the annual precipitation, respectively. Snowfall, occurring from October through May, averages 85 inches per year. The maximum annual precipitation recorded over a 24-year period was 24.87 inches (63.17 centimeters) measured in 1969.

2.2.3 Topography and Drainage

The natural environment in the vicinity of the Plant and is influenced primarily by its proximity to the Front Range of the Rocky Mountains. Specifically, the Plant is situated directly east of the north-south trending Rocky Mountains at an elevation of approximately

6,000 ft above mean sea level (msl), on a broad, eastward sloping plain of overlapping alluvial fans (Figure 2-2). The fans extend approximately 5 miles eastward from their origin in the abruptly rising Front Range, and terminate on low rolling hills at a break in slope. The operation area of the Plant is located 16 miles east of continental divide, on a terrace between valleys cut by North Walnut Creek and Woman Creek near the eastern edge of the fans.

Three intermittent streams drain the Rocky Flats Plant flowing generally from west to east. These drainages are Rock Creek, Walnut Creek, and Woman Creek. Rock Creek drains the northwestern corner of the Plant and flows northeast through the buffer zone to its off-site confluence with Coal Creek. An east-west trending topographic divide bisects the Plant separating the Walnut and Woman Creek drainages. North and South Walnut Creeks and an unnamed tributary drain the northern portion of the Plant security area. These three forks of Walnut Creek join in the buffer zone and flow to Great Western Reservoir approximately one mile east of the confluence. Woman Creek drains the southern Rocky Flats Plant buffer zone flowing eastward to Standley Reservoir. The South Interceptor Ditch lies between the Plant and Woman Creek. The South Interceptor Ditch collects runoff from the southern Plant security area and diverts it to Pond C-2, where it is monitored in accordance with the Plant National Pollutant Discharge Elimination System (NPDES) permit prior to discharge to Woman Creek.

2.2.4 Biota

A variety of vegetation exists within the Plant boundary, including species of flora representative of tall grass prairie, short grass plains, lower mountain, and foothill ravine regions. None of the vegetative species present are listed on the endangered species list. Vegetative cover along the Front Range of the Rocky Mountains has been radically altered for many years by human activities including burning, timber cutting, road building, and overgrazing; however, since acquisition of the Rocky Flats property for construction of the

Plant, vegetation has recovered, as evidenced by the presence of disturbance sensitive grass species like big bluestem (*Andropogon gerardii*) and sideoats grama (*Bouteloua curtipendula*). No vegetative stress attributable to hazardous waste contamination have been identified.

The fauna inhabiting the Rocky Flats Plant and its buffer zone consist of species associated with western prairie regions. The most common large mammal is the mule deer (*Odocoileus lemionus*), with an estimated 100-125 permanent residents in the vicinity of the Plant and the surrounding buffer zone. Small carnivores, such as the coyote (*Canis latrans*), red fox (*Vulpes fulva*), striped skunk (*Mephitis mephitis*), and long-tailed weasel (*Mustela frenata*) are also present. A profusion of small herbivores can be found throughout the Plant and buffer zone, consisting of species such as the pocket gopher (*Thomomys sp.* and *Perognathus sp.*), white-tailed jackrabbit (*Lepus townsendii*), and the meadow vole (*Microtus pennsylvanicus*).

Birds commonly observed in the vicinity of the Plant and the surrounding buffer zone include western meadowlarks (*Sturnella neglecta*), horned larks (*Eremophila alpestris*), mourning doves (*Zenaidura macroura*), and vesper sparrows (*Pooecetes gramineus*). A variety of ducks, killdeer (*Charadrius vociferus*), and red-winged black birds (*Agelaius phoeniceus*) have been observed in areas adjacent to ponds on which mallards (*Anas platyrhynochos*) and other ducks (*Anas sp.*) frequently nest and rear young. Common birds of prey in the area include marsh hawks (*Circus cyaneus*), red-tailed hawks (*Buteo jamaicensis*), ferruginous hawks (*Buteo regalis*), rough-legged hawks (*Buteo lagopus*), and great horned owls (*Bubo virginianus*).

Bull snakes (*Pituophis melanoleucus*) and rattlesnakes (*Crotalus sp.*) are the most common reptiles in the vicinity of the Plant and the surrounding buffer zone. Eastern yellow-bellied racers (*Coluber constrictor*) have also been observed. The eastern short-horned lizard (*Phrynosoma douglassi brevirostre*) has been reported on the site, but these and other lizards are not commonly observed. The western painted turtle (*Chrysemys picta*) and the western plains garter snake (*Thamnophis radix*) are present in the vicinity of many of the ponds.

2.3 GEOLOGY AND HYDROLOGY

Geologic units at the Rocky Flats Plant listed in descending order include surficial units (the Rocky Flats Alluvium, various terrace alluviums and colluvium, and valley fill alluvium (Figure 2-3)) and bedrock units (the Arapahoe Formation, the Laramie Formation, and the Fox Hills Sandstone (Figure 2-4)). Groundwater is present under unconfined conditions in both the surficial and bedrock units. Confined groundwater flow also occurs in bedrock sandstones.

2.3.1 Rocky Flats Alluvium

The Rocky Flats Alluvium is present beneath a large portion of the Plant, and is comprised of broad planar deposits consisting of topsoil underlain by up to 100 ft of clay, silt, sand, and gravel. Groundwater is present under unconfined conditions in the relatively permeable Rocky Flats Alluvium. Groundwater in the Rocky Flats Alluvium generally flows from west to east in the direction of drainages. Buried paleochannels in bedrock surfaces also control groundwater flow direction. The water table in the Rocky Flats Alluvium rises in response to recharge during spring, and recedes throughout the remainder of the year. Recharge in the alluvium occurs as precipitation, snowmelt, and water losses from ditches, streams, and ponds which intersect the alluvium. Discharge from the alluvium occurs at minor seeps in the colluvium, which covers the contact between alluvium and underlying bedrock along the edges of valleys. The Rocky Flats Alluvium thins to the east of the Plant boundary, and does not supply water directly to wells located downgradient of the Plant.

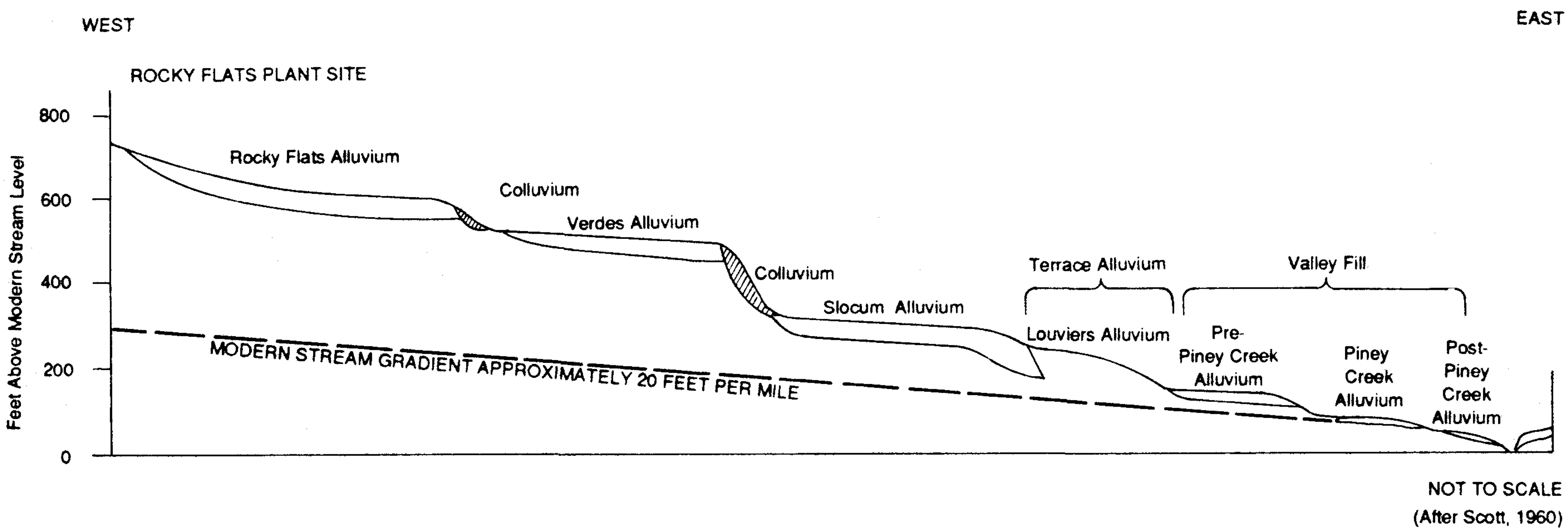

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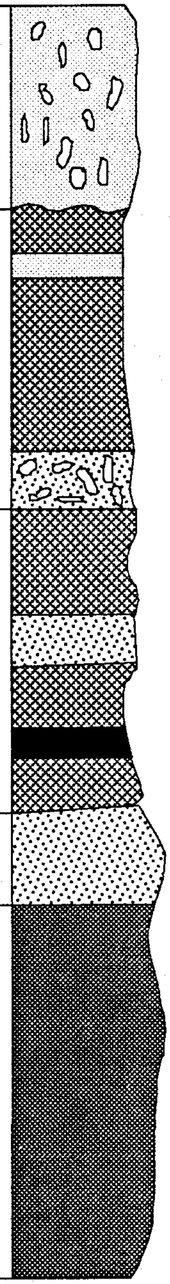
FIGURE 2-3
Erosional Surfaces and Alluvial Deposits East of the Front Range, Colorado

Quaternary	Alluvium	0-60'	Conglomerate in sandy clay matrix
Upper Cretaceous	Arapahoe Formation	0-300'	Tan sandy claystone and clayey sandstone; conglomeratic sandstone at base
	Laramie Formation	500'	Grey, fine-to-medium grained sandstone and silty clays; thin coal beds in lower part
	Fox Hills Sandstone	60'	Tan, fine-to-medium grained sandstone and sandy shale
	Pierre Shale	± 8000'	Dark grey, silty shale and few thin, silty sandstones



June 1990

Ebasco Services Incorporated
Prepared for:
EG & G, Rocky Flats Plant

Figure 2-4

Generalized Stratigraphic Section, Rocky Flats Area

After LeRoy and Weimer, 1971

2.3.2 Other Alluvial Deposits

Various other alluvial deposits occur topographically below the Rocky Flats Alluvium in the Plant drainages. Colluvium (slope wash) mantles the valley side slopes between the Rocky Flats Alluvium and the valley bottoms. In addition, remnants of younger terrace deposits including the Verdos, Slocum, and Louviers Alluvia occur occasionally along the valley side slopes. Recent valley fill alluvium occurs in the active stream channels.

Unconfined groundwater flow occurs in these surficial units. Recharge is from precipitation, percolation from streams during periods of surface water runoff, and by seeps discharging from the Rocky Flats Alluvium. Discharge is by evapotranspiration and by seepage into other geologic formations and streams. The direction of groundwater flow is generally downslope through colluvial materials and then along the course of the stream in valley fill materials. During periods of high surface water flow, water is lost to bank storage in the valley fill alluvium and returns to the stream after the runoff subsides.

2.3.3 Arapahoe Formation

The Arapahoe Formation underlies surficial materials beneath the Plant. The Arapahoe Formation consists of claystone with thin lenticular sandstones. Total formation thickness varies up to 270 ft. The permeable zones of the Arapahoe Formation are lenticular sandstones within the claystone. The lenticular sand bodies are composed of fine-grained sands and silts, and their hydraulic conductivity is low compared to the overlying Rocky Flats Alluvium. A seismic reflection survey is currently being implemented at the Plant to further characterize bedrock geology.

The Arapahoe Formation is recharged by leakage from streams and groundwater movement from overlying surficial deposits. The main recharge areas are under the Rocky Flats Alluvium, although some recharge from the colluvium and valley fill alluvium likely occurs along the stream valleys. Recharge is greatest during the spring and early summer when rainfall and stream flow are at a maximum and water levels in the Rocky Flats Alluvium are high. Groundwater movement in the Arapahoe Formation is generally toward the east, although flow within individual sandstones is not fully characterized at this time. Regional groundwater flow in the Arapahoe Formation is toward the South Platte River in the center of the Denver Basin.

2.3.4 Laramie Formation and Fox Hills Sandstone

The Laramie Formation underlies the Arapahoe Formation and is composed of two units: a thick upper claystone and a lower sandstone. The claystone is greater than 700 ft thick and is of very low hydraulic conductivity; therefore, the U.S. Geologic Survey (USGS) (Hurr, 1976) concludes that Plant operations will not impact any units below the upper claystone unit of the Laramie Formation.

The lower sandstone unit of the Laramie Formation and the underlying Fox Hills Sandstone comprise a regionally important aquifer in the Denver Basin known as the Laramie-Fox Hills Aquifer. These units subcrop west of the Plant and can be seen in clay pits excavated through the Rocky Flats Alluvium. The steeply dipping beds of these units quickly flatten to the east. Recharge to the aquifer occurs along the rather limited outcrop area exposed to surface water flow and leakage along the Front Range.

3.0 INITIAL EVALUATION

This section of the RFI/RI Work Plan presents information regarding OU 3 Other Outside Closures site locations and descriptions, site histories, previous investigations, and site conceptual models.

The conceptual models include information regarding known and potential sources of contamination, types of contaminants, known and potential exposure pathways, and known or potential human and environmental receptors. The conceptual models assist in identifying sampling locations discussed in the FSP and preliminary identification of possible remedial alternatives. The following 13 sites are included in OU 3 Other Outside Closures and are shown on Figure 3-1:

- Building 443 No. 4 Fuel Oil Tank (Solid Waste Management Unit (SWMU) 129)
- Property Utilization and Disposal (PU&D) Container Storage Yard-Waste Spills (SWMU 174)
- Swinerton and Walberg (S&W) Building 980 Container Storage Facility (SWMU 175)
- Swinerton and Walberg (S&W) Contractor Storage Yard (SWMU 176)
- Building 885 Drum Storage Area (SWMU 177)
- Building 334 Cargo Container Area (SWMU 181)
- Building 444/453 Drum Storage Area (SWMU 182)
- Building 460 Sump #3 Acid Side (SWMU 205)
- Inactive D-836 Hazardous Waste Tank (SWMU 206)
- Inactive Building 444 Acid Dumpsters (SWMU 207)
- Inactive 444/447 Hazardous Waste Storage Area (SWMU 208)
- Unit 15, 904 Pad Pondcrete Storage (SWMU 213)
- Unit 25, 750 Pad Pondcrete and Saltcrete Storage (SWMU 214)

3.1 BUILDING 443 NO. 4 FUEL OIL TANK (SWMU 129)

The following discussion is summarized primarily from the Closure Plan for the Building 443 No. 4 Fuel Oil Tank (Rockwell International et al., 1988a) and the RCRA Part B Permit Application for the Rocky Flats Plant Hazardous and Radioactive Mixed Wastes (Rockwell International et al., 1987).

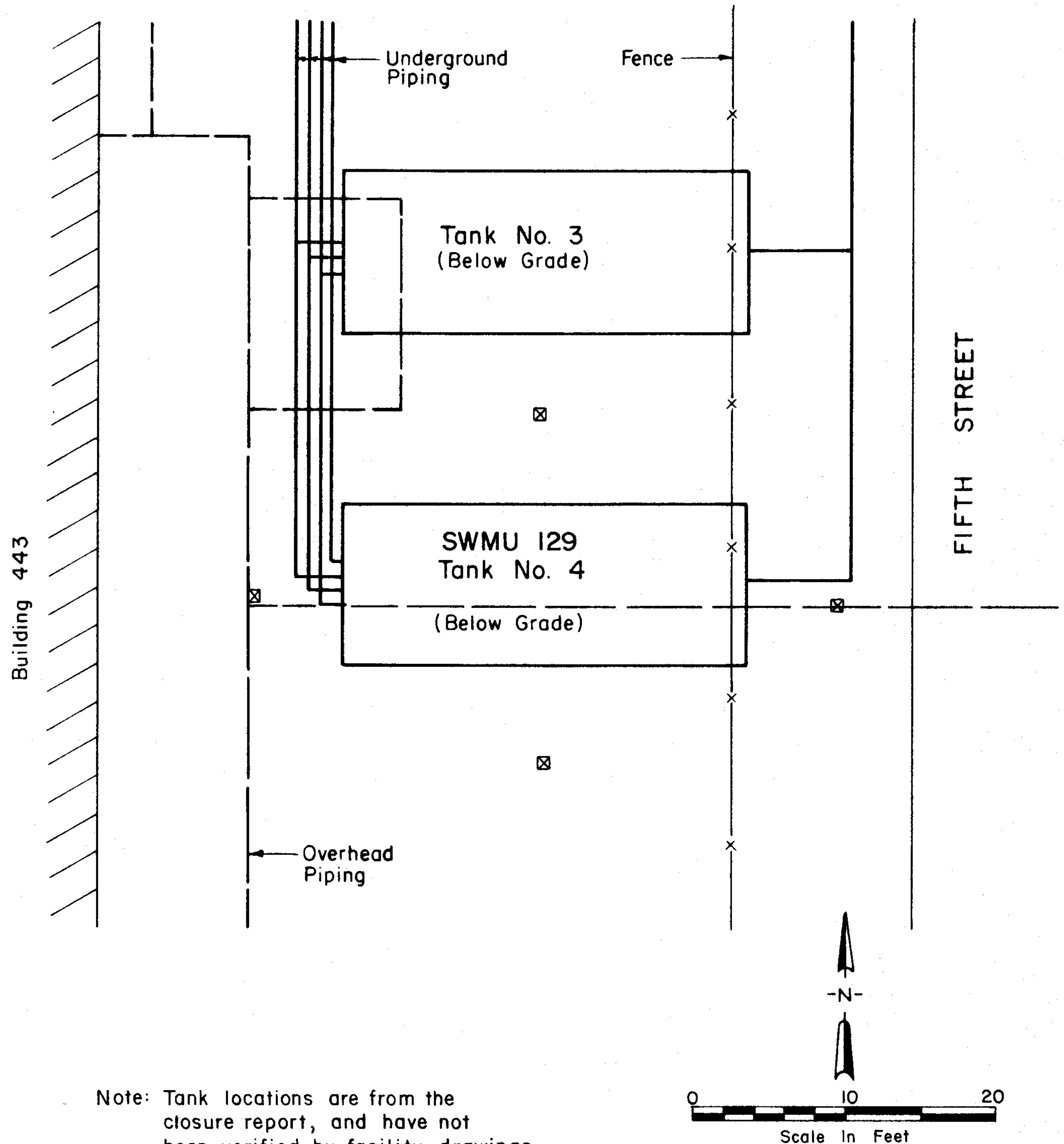
3.1.1 Location and Description

The Building 443 No. 4 Fuel Oil Tank (SWMU 129) is one of four fuel oil tanks located approximately 25 ft east of Building 443 (Figure 3-2). The four fuel oil tanks are oriented longitudinally east to west in a north-south line. The No. 4 Fuel Oil Tank is the southernmost of these tanks. The top of the carbon steel tank is located approximately 4 ft below grade without secondary containment. The Tank is 11 ft in diameter by 27 ft in length with a total storage capacity of approximately 19,000 gallons.

Five pipelines are associated with the No. 4 Fuel Oil Tank (Figure 3-2). Four steel supply and return lines connect each of the four tanks to Building 443. These four lines consist of a steam line to supply the heaters located inside each tank, a return condensation line from the heaters, a pump line to pump fuel oil to Building 443, and a return line for oil being circulated from the Building 443 boilers. An additional aboveground line connects two supply tanks south of Building 551 to the four tanks. The portion of this line connected to the No. 4 Fuel Oil Tank is an underground steel pipe.

3.1.2 History

Four fuel oil tanks historically supplied #6 fuel oil to the Building 443 steam plant. Two of the tanks were installed in 1952, while the No. 4 Fuel Oil Tank and another tank were installed in 1967. Although the No. 4 Fuel Oil Tank was primarily used to store #6 fuel oil from 1967 to 1984, for a time period in the 1970s it was used to store #2 diesel oil. From 1984 to 1986, the No. 4 Fuel Oil Tank was used to store a waste mixture of water and compressor oil prior to disposal. The compressor waste was a mixture of approximately 9 parts water to 1 part oil and was stored at a rate up to approximately 30 gallons per day. Solvents used to clean equipment and for cleaning up fuel oil spills have



Note: Tank locations are from the closure report, and have not been verified by facility drawings.

Legend

⊠ Previous Soil Sample Location

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FIGURE 3-2

Building 443 No. 4 Fuel Oil Tank (SWMU 129) also been historically added to the No. 4 Fuel Oil Tank from 1967 to 1986. Reportedly, solvents were not added to any of the other tanks. The solvents were added by pouring them through a vertical pipe located at the east end of the No. 4 Fuel Oil Tank. Approximately 55 gallons of solvent were used every two years in Building 443 corresponding to the approximate quantity of solvents added to the No. 4 Fuel Oil Tank. Use of the No. 4 Fuel Oil Tank was discontinued in 1986 when a 4 ft deep fence post hole excavation located approximately 6 inches east of the eastern edge of the No. 4 Fuel Oil Tank partially filled with a material visually identified as compressor oil. Subsequently, the contents of the No. 4 Fuel Oil Tank, approximately 12,900 gallons of material, were removed in 1986. Minor amounts of sludge may remain in the No. 4 Fuel Oil Tank and associated lines.

There were no documented decreases in the level of material stored in the No. 4 Fuel Oil Tank which would have indicated releases of material. The source of the material in the fence post hole is believed to be spills associated with filling and also possible leakage from the No. 4 Fuel Oil Tank. This theory is supported by documented increases of the level of material in the No. 4 Fuel Oil Tank due to groundwater entering through a leak on the top of the tank. A summary of information pertaining to releases of fuel oil in the vicinity of the four #6 fuel oil tanks is presented below.

During 1967 and 1968, reported #6 fuel oil spills were traced to overfilling the supply tanks due to inadequate instrumentation. The amount of fuel oil released is unknown.

In November 1977, approximately 600 gallons of #6 fuel oil were recovered from the sewage treatment plant. A cracked transfer pipe in an underground pipeline near the No. 4 Fuel Oil Tank was determined to be the source of the material. The oil had reportedly leaked out of the pipe, travelled through the pipe backfill and bedding materials, and eventually seeped into a sump in Building 443 that was connected to the sewage treatment plant. The total amount of material released is unknown. The pipe was repaired, and oil-contaminated soil encountered in the excavation was disposed in the Rocky Flats sanitary landfill.

Following the observation of material in the fence post hole east of the No. 4 Fuel Oil Tank, a trench approximately 3 ft wide, 4 ft deep, and 100 ft long was excavated east of the four Building 443 fuel oil tanks. The western edge of the trench was located approximately 3 to 4 ft east of the four fuel oil tanks. Visual evidence of dark fuel oil stains on soils were observed in the southern 30 ft of the trench, immediately east of the No. 4 Fuel Oil Tank, believed to be related to previously mentioned spills and leakage events. No free product was present in the trench.

3.1.3 <u>Previous Investigations</u>

In 1986, samples were collected of the material stored in the No. 4 Fuel Oil Tank and of the liquid that partially filled the excavated fence post hole east of the No. 4 Fuel Oil Tank. These samples were analyzed by both an on-site and an independent laboratory. The volatile organic compounds trichloroethylene, 1,1,1-trichloroethane, methylene chloride, and trichlorofluoromethane were detected in materials stored in the No. 4 Fuel Oil Tank. All of these compounds except trichloroethylene were also detected in the sample of material visually identified as compressor oil collected from the fence post hole. The Closure Plan for the No. 4 Fuel Oil Tank (Rockwell International et al., 1988a) indicates that the No. 4 Fuel Oil Tank was the potential source of volatile organics in the material collected from the fence post hole.

Results of groundwater analyses from five quarterly samplings of nearby Well 44-86 in 1986 and 1987 are presented in the Closure Plan for the No. 4 Fuel Oil Tank (Rockwell International et al., 1988a). Trichloroethylene, 1,1,1-trichloroethane, and methylene chloride were the analytes detected in the No. 4 Fuel Oil Tank and/or the fence post hole that were also sampled for in Well 44-86. 1,1,1-Trichloroethane was found in two out of five sampling events; in one of these samples it was less than one order of magnitude below the maximum contaminant level (mcl) of 0.20 milligrams per liter (mg/l), and in the other sample it was actually an estimated value below the analytical detection limit. Methylene chloride was detected in one out of two sampling events. The value for methylene chloride was actually an estimated value below the detection limit. Methylene chloride was also detected in a blank. Trichloroethylene was not detected in five out of five sampling events. The Closure Plan for the No. 4 Fuel Oil Tank (Rockwell International et al., 1988a) suggests that these analytical results from Well 44-86 are not necessarily related to the No. 4 Fuel Oil Tank.

An initial soil characterization program to determine the nature and extent of soil contamination was specified in the Closure Plan for the Building 443 No. 4 Fuel Oil Tank. Subsequent to submittal of this Closure Plan, soil samples were obtained in 1988 from the approximate four locations shown on Figure 3-2 (Weston, 1988). These borings were proposed to extend 10 ft below the water table or to a maximum depth of 30 ft. The actual depth of these borings is presently unknown. It was also proposed that continuous samples would be field screened by visual surveys to identify areas of visual contamination and a portable gas chromatograph to determine the presence of trichloroethylene or 1,1,1-trichloroethane. Analysis of soil samples included Hazardous Substance List (HSL) volatile organic acids (VOAs), HSL base neutral acid extractable organics (BNAs), and HSL metals. The laboratory results are not known to have been validated (Schoendaller, 1990).

The HSL VOAs detected included acetone, benzene, ethylbenzene, methylene chloride, toluene, total xylenes, and 1,1,1-trichloroethene. The HSL BNAs detected included benzo(a)anthracene, chrysene, pyrene, and 2-methylnaphthalene. Several of the HSL VOAs and BNAs detected were estimated values which were detected below the detection limits. Because numerous HSL metals were detected only metals detected above background levels established in the draft Phase III RI/FS Work Plan for the 881 Hillside Area (DOE, 1990) will be presented. Cadmium was detected slightly above background concentrations while lead was detected at elevated concentrations. The analytical results indicate the presence of fuel oil and solvents in the vicinity of the Building 443 No. 4 Fuel Oil Tank.

3.1.4 Conceptual Model

3.1.4.1 Contaminant Sources

Spills or leakage related to the No. 4 Fuel Oil Tank and its five associated lines are the primary probable sources of contaminants at SWMU 129. The contaminated soil is a secondary contaminant source. Prevalent soil staining and laboratory results indicate soil contamination. These contaminants include fuel-related compounds, solvents, and metals.

3.1.4.2 Potential Exposure Pathways

The probable exposure pathway for contaminants include water infiltration from precipitation and surface runoff to the water table; nonaqueous-phase liquid infiltration to the water table; and contaminated soils.

3.1.4.3 Potential Receptors

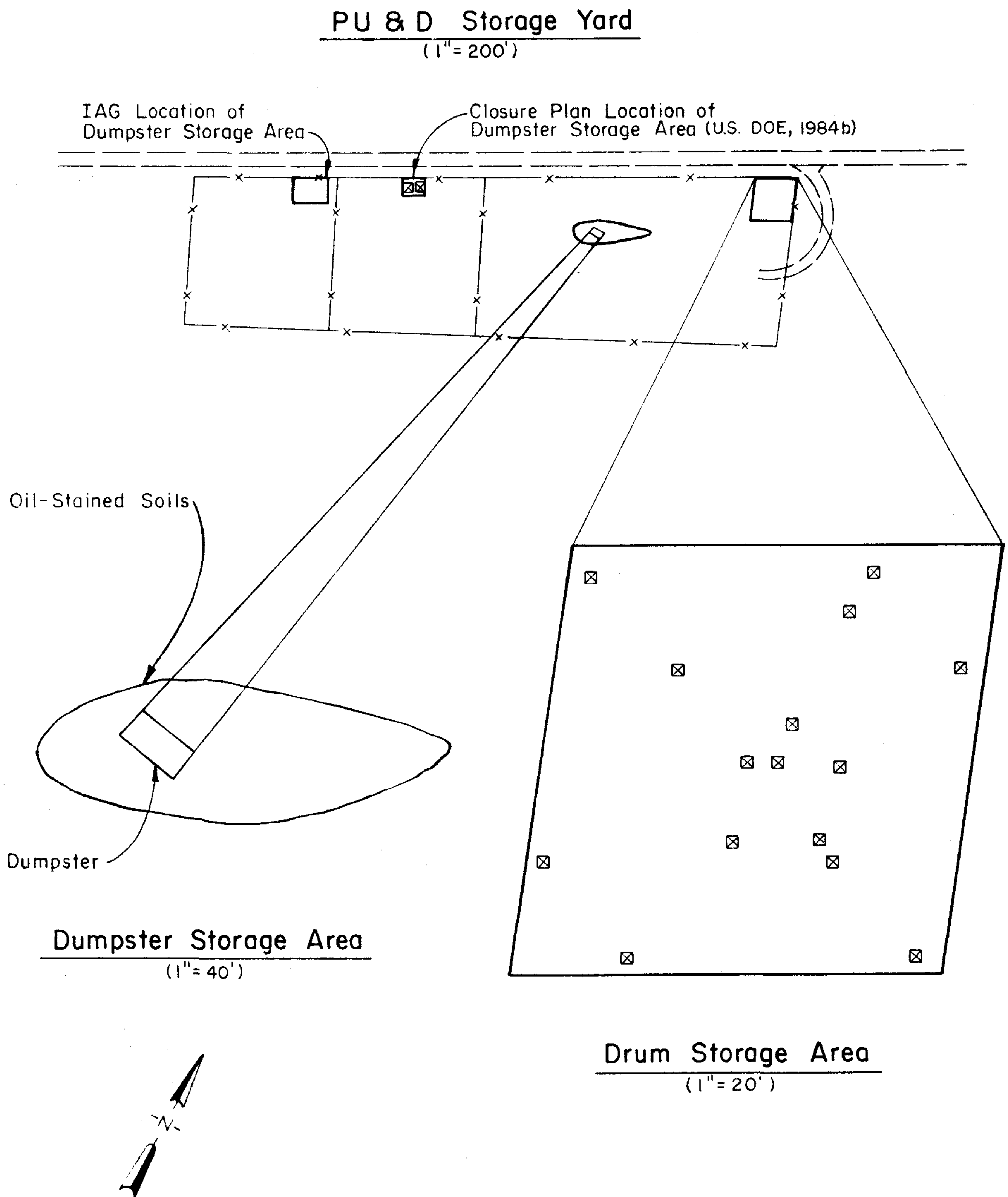
Potential receptors for contaminants could include humans and terrestrial biota through dermal contact with contaminated soils, and humans through ingestion or dermal contact with groundwater.

3.2 PROPERTY UTILIZATION AND DISPOSAL (PU&D) CONTAINER STORAGE YARD -WASTE SPILLS (SWMU 174)

The following discussion is summarized primarily from the Closure Plan for the Container Storage Facilities (Rockwell International et al., 1988b).

3.2.1 Location and Description

Two separate areas are located within the PU&D Container Storage Yard (Figure 3-3). The Drum Storage Area of SWMU 174 is a square area located in the northeast corner of the PU&D Container Storage Yard with dimensions of approximately 60 by 60 ft. The Dumpster Storage Area of SWMU 174 was reportedly located along the northern fence line approximately 300 ft east of the western fenceline of the Container Storage Yard. However, PU&D Container Storage Yard personnel and areal photographs indicate that the Dumpster Storage Area is located away from the fence near the center of the Container Storage Yard and occupies a larger area than previously indicated (Elvey, 1990).



Legend

⊠ Previous Soil Sample Location

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FIGURE 3-3

P U & D Storage Yard - Waste Spills (SWMU 174)

3.2.2 <u>History</u>

3.2.1.1 Drum Storage Area

Operations began in the Drum Storage Area between 1974 and 1976 and ended in 1985. The Drum Storage Area was used for storage of 55-gallon steel drums, primarily containing waste oils from equipment and vehicle maintenance as well as waste paints and paint thinners from the Rocky Flats Paint Shop. These drums were placed directly on the ground surface without secondary containment. The drums and their contents were periodically sold for recycling until 1984, when the oil was determined to contain hazardous constituents. It has been estimated that a total of 460 drums were stored during the operation of the Drum Storage Area, although the maximum number of drums stored at any one time may have been considerably less. Assuming a total drum storage of 460 drums, this corresponds to a total storage capacity of 25,300 gallons over its operating life. Drums were generally accumulated for one to two years prior to removal and sale for recycling. In August 1985 the drums were removed from the site for disposal.

3.2.2.2 Dumpster Storage Area

The Dumpster Storage Area of SWMU 174 was used from 1974 to 1985 for storage of stainless steel machining chips that were coated with lathe coolant. The coolant was either freon based, or composed of approximately 70 percent hydraulic oil and 30 percent carbon tetrachloride. Only one 12 by 16 ft dumpster was used to contain the coated chips at any one time with a total storage capacity of 860 cubic ft. The dumpster was located directly on the ground surface without secondary containment. Storage of RCRA-regulated materials in the dumpster was discontinued in 1985, possibly due to elimination of solvents from the chip generating process. Currently, one dumpster is reportedly used at this location to store stainless steel chips prior to recycling, while two other dumpsters located in the vicinity are used to store carbon steel prior to recycling.

During a site visit in May 1990, it was observed that machined steel is currently stored near the middle of the PU&D Container Storage Yard in a dumpster located several hundred feet from the reported location of the Dumpster Storage Area. Stained soil was also observed in the vicinity of this area. In addition, dumpsters were not observed at the reported Dumpster Storage Area location. PU&D Storage Yard personnel have indicated that the Dumpster Storage Area has been in the same location for many years (Elvey, 1990). Inspection of air photos revealed a patch of stained soil near the middle of the Storage Yard in 1985, which coincides with the current dumpster location. The dumpsters in current use reportedly do not contain hazardous constituents.

There have been no documented spills at the Drum or Dumpster Storage Areas. Radioactive contamination is reportedly not expected to be present due to administrative controls at the Rocky Flats Plant.

3.2.3 Previous Investigations

In May 1985, samples were collected from 101 of the remaining 158 drums, composited into twelve samples and analyzed. The oil layers of the composited samples were analyzed quantitatively to determine their base materials. The remaining portions of the sample were analyzed by infrared spectroscopy. Components of the drummed waste were determined to include paraffinic base mineral oil, a volatile hydrocarbon solvent (e.g., mineral spirits: aliphatic naphtha), carbon dioxide, methyl alcohol, silicone lubricant, freon, freon TF, water, and xylenes. Metals detected in the samples included aluminum, barium, beryllium, calcium, chromium, copper, iron, potassium, lithium, magnesium, molybdenum, sodium, nickel, lead, silicon, and zinc.

An initial soil characterization program to determine the nature and extent of soil contamination was specified for the Drum and Dumpster Storage Areas in the Closure Plan for the Container Storage Facilities (Rockwell International et al., 1988b). Subsequent to submittal of the Closure Plan, soil samples were obtained in 1988 from the approximate locations shown on Figure 3-3 (Weston, 1988). Only 50 percent of the proposed soil samples were collected while awaiting final approval of the Closure Plan. These soil samples were collected from 1 ft deep excavations and were composited over the 1 ft interval except for VOA samples which were grab samples from a depth of 1 ft. Analysis of soil samples included HSL VOAs, HSL BNAs, HSL metals, inorganics, and radionuclides. The laboratory results for these samples are not known to have been validated (Schoendaller, 1990).

Prior to soil sampling, visual and direct radiation surveys were also conducted at the Drum and Dumpster Storage Areas to identify areas of potential contamination. The radiation surveys consisted of gamma surveys with a Field Instrument for Detection of Low Energy Radiation (FIDLER). Areas of stained soil or above background radiation levels were included in stratified sampling in addition to the random systematic grid sampling program established in the Closure Plan.

3.2.3.1 Drum Storage Area

Five soil samples were collected from areas of soil staining and ten samples were collected based on the random systematic grid sampling program (Figure 3-3). The HSL VOAs detected included acetone, ethylbenzene, methylene chloride, tetrachloroethene, toluene, total xylenes, and 1,1,1-trichloroethane. The HSL BNAs detected included anthracene, benzo(a)anthracene, benzoic acid, bis(2-ethylhexyl)phthalate, chrysene, fluoranthene, phenanthrene, phenol, pyrene, and 4-chloro-3-methyl phenol. Several of the HSL VOAs and BNAs found were actually estimated values which were below the detection limits. Because numerous HSL metals were detected only metals detected above background levels established in the draft Phase III RI/FS Work Plan for the 881 Hillside Area (DOE, 1990) will be presented. Beryllium, cadmium, lead, sodium, strontium, vanadium, and zinc were detected at concentrations above background. Cadmium and vanadium were detected at elevated concentrations in one and two samples respectively. The inorganics and radionuclides detected were not above background concentrations.

During the visual surveys, several areas of stained soil and stressed vegetation were observed in the Drum Storage Area. Staining was also observed in the northeast portion of this area where a dumpster of vanadium shavings was previously stored. Some shavings were still present on the ground surfaces. No areas were determined to exceed background gamma radiation levels during the FIDLER survey.

3.2.3.2 Dumpster Storage Area

The soil characterization program of the Dumpster Storage Area was conducted at the reported SWMU located along the northern fence line approximately 300 ft east of the western fenceline of the Container Storage Yard. As discussed in Section 3.2.2, it is not likely that the sampled location was the actual location of the Dumpster Storage Area. Two soils samples were collected based on the random systematic grid sampling program (Figure 3-3). The HSL VOAs detected included acetone, methylene chloride, and toluene. The HSL BNAs detected included bis(2-ethylhexyl)phthalate), fluoranthene, N-nitrosodiphenylamine, and di-n-butyl phthalate. Several of the HSL VOAs and BNAs found were actually estimated values below the detection limits. In addition, methylene chloride and di-n-butyl phthalate were detected in the blank as well as in the sample. Because numerous HSL metals were detected only metals detected above background levels established in the draft Phase III RI/FS Work Plan for the 881 Hillside Area (DOE, 1990) will be presented. Antimony, copper, lead, magnesium, manganese, sodium, and zinc were detected at levels above background concentrations. The inorganics and radionuclides detected were not above background concentrations.

No areas of ground staining were observed during the visual surveys and no areas were determined to exceed background gamma radiation levels during the FIDLER survey.

3.2.4. <u>Conceptual Model</u>

3.2.4.1 Contaminant Sources

Stored drums of waste oils, paints and paint thinners, and a dumpster of stainless steel chips coated with lathe coolant have been identified as the primary sources of potential contamination at SWMU 174. Primary sources of hazardous waste have been removed from the site. The drums and dumpster were stored directly on the ground surface, and may have contributed to soil contamination by leaks and spills. Contaminated soil at the Drum Storage Area is confirmed by observations of staining and detection of volatile and semivolatile organics and above-background concentrations of metals in the soil.

3.2.4.2 Potential Exposure Pathways

Potential exposure pathways for contaminants associated with SWMU 174 include soil contamination, windblown dust or volatile emissions, storm water runoff, and infiltration to groundwater.

3.2.4.3 Potential Receptors

Potential receptors for contaminants could include humans and terrestrial biota through dermal contact or ingestion of contaminated soil; humans and terrestrial biota through inhalation of contaminated windblown dust or volatiles emissions; human, terrestrial and aquatic biota through ingestion or dermal contact with storm water runoff; and humans through ingestion or dermal contact with contaminated groundwater.

3.3 SWINERTON AND WALBERG (S&W) BUILDING 980 CONTAINER STORAGE FACILITY (SWMU 175)

The following discussion is summarized primarily from the Closure Plan for the Container Storage Facilities (Rockwell International et al., 1990). The area of SWMU 175 was reportedly regraded in the Spring of 1988.

3.3.1 Location and Description

The S&W Building 980 Container Storage Facility (SWMU 175) is reportedly located in the eastern third of a storage yard located south of Building 980 (Figure 3-4) and has dimensions of approximately 25 by 25 ft (Figure 3-4). The precise location of SWMU 175 could not be determined during a site visit in May 1990. The area of SWMU 175 was reportedly regraded in the Spring of 1988.

3.3.2 History

SWMU 175 was used from approximately 1980 to 1986 for storage of 55-gallon steel drums containing wastes generated by the S&W contractor's maintenance and fabrication shops. These wastes typically came from vehicle maintenance and painting activities. A maximum of ten drums containing hazardous waste have been stored at any one time. The drums were placed directly on the ground surface. A berm approximately 1 to 1.5 ft high

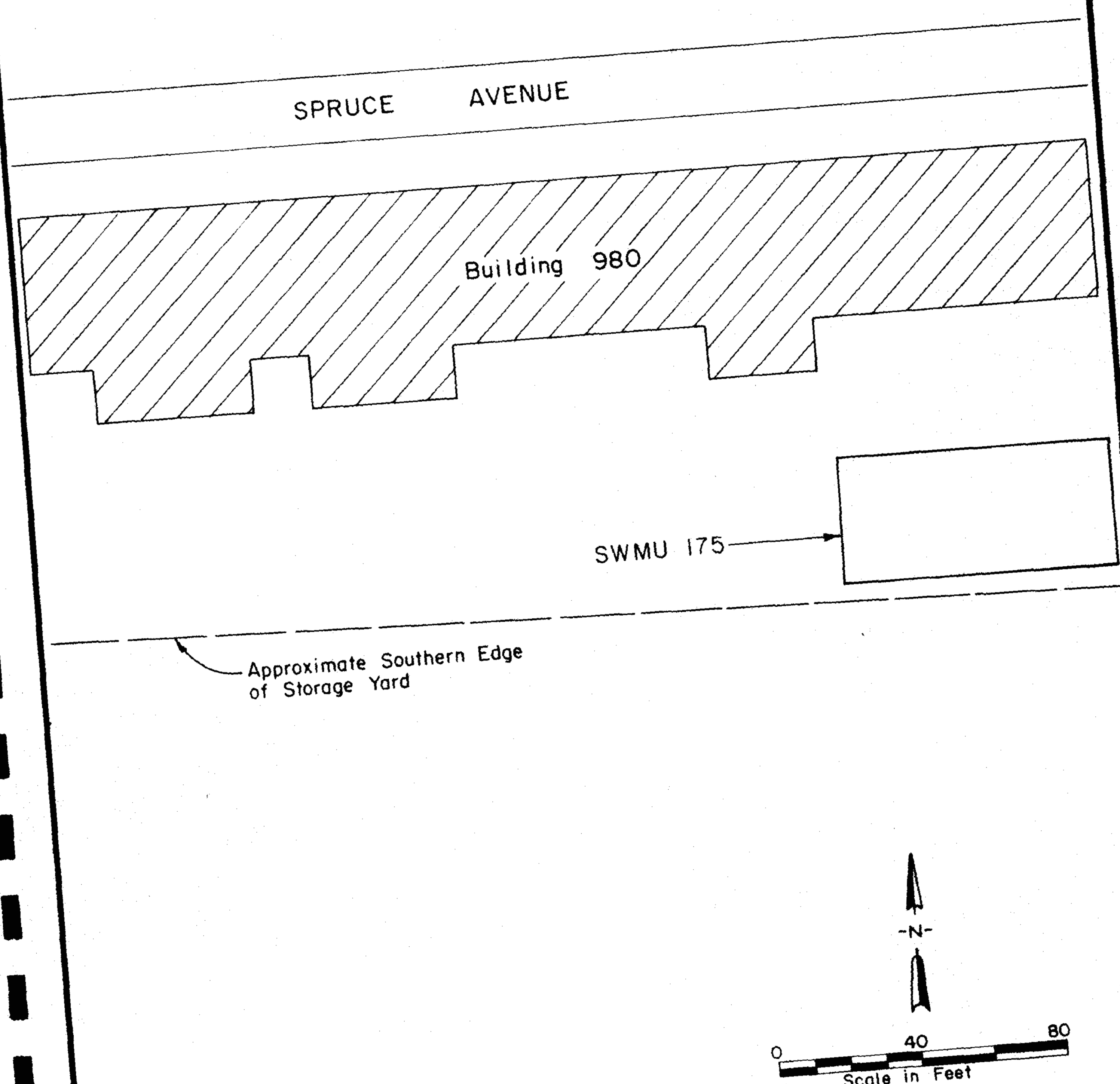

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FIGURE 3-4
S&W Building 980 Container Storage Facility (SWMU 175)

was reportedly located on the west, south, and east sides of the overall storage yard. There have been no documented spills or leaks from this area; however, visual evidence of staining of the ground surface exists. Radioactive contamination is reportedly not expected to be present due to administrative controls at the Rocky Flats Plant. The area has been used from 1986 to the present as a 90-day accumulation area.

3.3.3 Previous Investigations

In May 1985, samples were collected from seven drums, composited into five samples and qualitatively analyzed. The oil layers of the composited samples were analyzed to determine their base materials and the remaining portions of the samples were analyzed by infrared spectroscopy. Components of the drummed waste were determined to include paraffinic based mineral oil, a mixture of paraffinic and naphthenic based mineral oil, xylenes, freon TF, and glycol ether/borate base brake fluid. Metals detected in the samples included aluminum, barium, beryllium, calcium, sodium, lead, silicon, and zinc.

An initial soil characterization program to determine the nature and extent of soil contamination was specified for the S&W Building 980 Container Storage Facility in the Closure Plan for the Container Storage Facilities (Rockwell International et al., 1988b). Subsequent to submittal of the Closure Plan, soil samples were obtained in 1988 from the approximate locations shown on Figure 3-4 (Weston, 1988). Only 40 percent of the proposed soil samples were collected while awaiting final approval of the Closure Plan. One soil sample was collected from an area of soil staining and three samples were collected based on the random systematic grid sampling program. These soils samples were collected from 1 ft deep excavations and were composited over the 1 ft deep interval except for VOA samples which were grab samples from a depth of 1 ft. Analysis of soil samples included HSL VOAs, HSL BNAs, HSL metals, inorganics and radionuclides. The laboratory results for these samples are not known to have been validated (Schoendaller, 1990).

Prior to soil sampling, a visual and a direct radiation survey were also conducted to identify areas of potential contamination. These surveys were conducted to identify areas for stratified sampling as previously described in Section 3.2.3.

The HSL VOAs detected included acetone and methylene chloride. Methylene chloride was also detected in 50 percent of the blanks for the samples. The HSL BNAs detected included bis(2-ethylhexyl)phthalate, fluoranthene, phenanthrene, and pyrene. All of the HSL BNAs found were actually estimated values which were below the detection limits. The BNA bis(2-ethylhexyl)phthalate was also detected in the blanks as well as in the samples.

Because numerous HSL metals were detected only metals detected above background levels established in the draft Phase III RI/FS Work Plan for the 881 Hillside Area (DOE, 1990) will be presented. Cadmium, copper, lead, mercury, and zinc were detected at levels above background concentrations. No inorganics were detected above background concentrations. Radionuclides were detected at above background concentrations in two samples. These radionuclides included gross alpha, gross beta, plutonium-239 and -240, and americium-241. Plutonium-239 and -240, and americium-241 were detected at elevated concentrations.

Several areas of ground staining were observed during the visual survey and it was noted that vegetation was sparse in the area. No areas were determined to exceed background levels of gamma radiation during the FIDLER survey.

3.3.4 Conceptual Model

3.3.4.1 Contaminant Sources

Stored drums of waste oils may be primary sources of contamination by metals, volatile organics, polyaromatic hydrocarbons, and radionuclides. Some contaminants, such as metals, plutonium, and americium, may be the result of windblown dispersion of contaminated dust from other primary sources. Contaminated soil is suggested by observations of staining, by analytical detection of volatile organics and polyaromatic hydrocarbons in the soil, and by above background concentrations of metals and radionuclides.

3.3.4.2 Potential Exposure Pathways

Potential exposure pathways for contaminants associated with SWMU 175 include soil contamination, windblown dust or volatile emissions, storm water runoff, and infiltration to groundwater.

3.3.4.3 Potential Receptors

Potential receptors for contaminants could include humans and terrestrial biota through dermal contact or ingestion of contaminated soil; humans and terrestrial biota through inhalation of contaminated windblown dust or volatile emissions; humans, terrestrial and aquatic biota through ingestion or dermal contact with storm water runoff; and humans through ingestion or dermal contact with contaminated groundwater.

3.4 SWINERTON AND WALBERG (S&W) CONTRACTOR STORAGE YARD (SWMU 176)

The following discussion is summarized primarily from the Closure Plan for the Container Storage Facilities (Rockwell International et al., 1988b).

3.4.1 Location and Description

The S&W Contractor Storage Yard (SWMU 176) is located approximately 50 ft east of the Solar Ponds in the vicinity of Building 964 (Figure 3-5). This Yard has been used for storage of contractor materials for use in various projects at the Rocky Flats Plant. SWMU 176 is approximately 290 by 390 ft in size according to the IAG (1989). The actual area of SWMU 176 used for storage appears to be considerably larger based on inspection of aerial photographs.

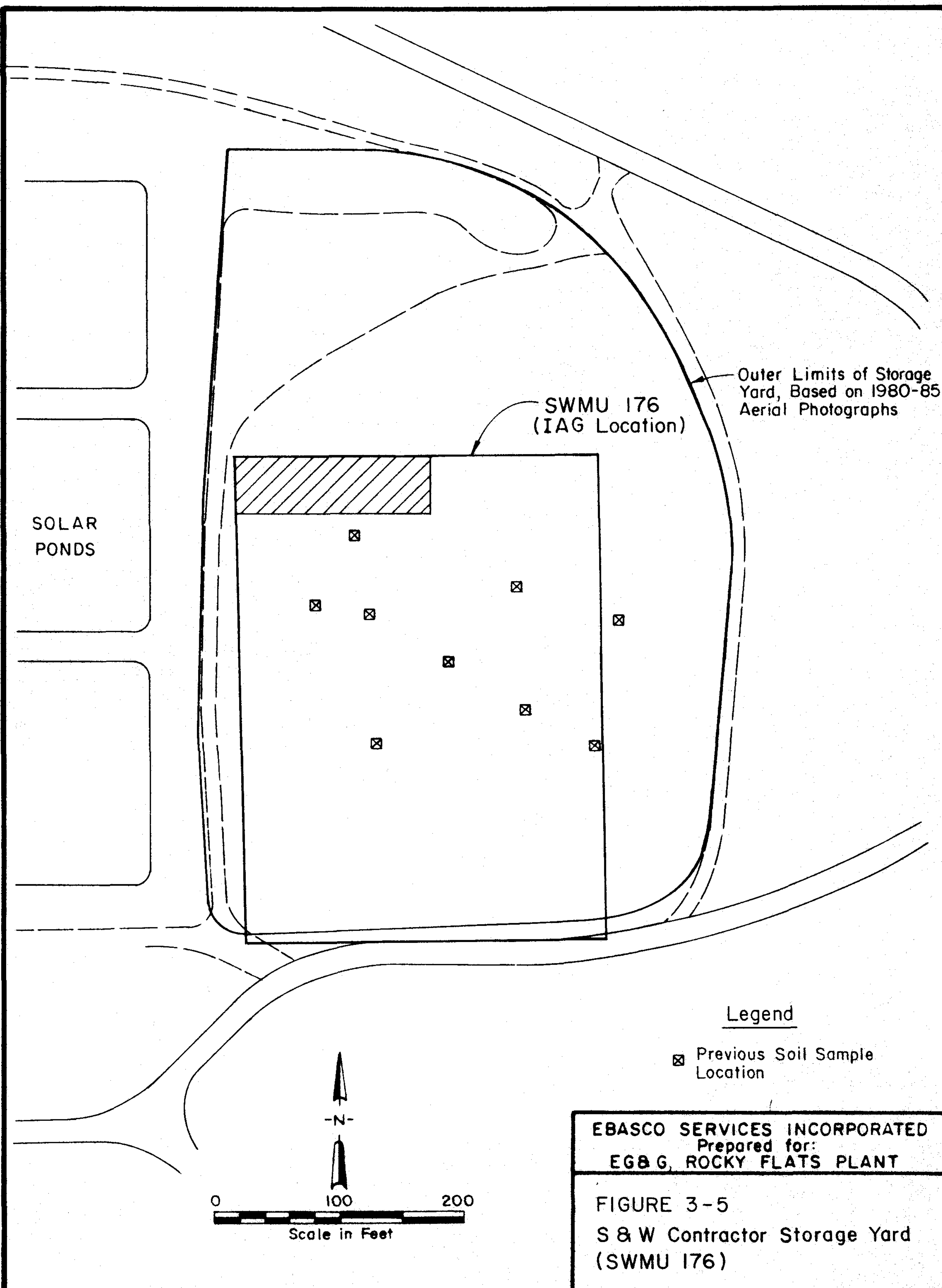

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FIGURE 3-5
S & W Contractor Storage Yard (SWMU 176)

3.4.2 History

The S&W Contractor Storage Yard has been used for storage since 1970. This area was not intended to be used for the storage of hazardous waste. Drum storage began at this site in 1970 and continued until 1985. Containers were stored in numerous areas of the Storage Yard throughout time. The total amount of waste stored at the Contractor Storage Yard is unknown. In 1985, materials were identified in several areas of the ContractorStorage Yard that qualified as hazardous waste. These containers had been placed directly on the ground surface or on pallets. The contents of the containers were sampled in 1985 and qualitatively analyzed. Components of the drummed waste were determined to be primarily mineral spirits, water, waste oil, volatile organics, and metals. The containers were subsequently removed and disposed as hazardous waste. Most of the Contractor Storage Yard area has been used for storage of surplus or raw materials for contractor use in construction or maintenance projects, rather than for drum storage or accumulation.

A site visit in May 1990 indicated that use of the S&W Contractor Storage Yard is diminishing. Air photos from 1967 to 1985 indicate that a larger area than the boundaries of SWMU 176 would suggest was used as a storage yard (see Figure 3-5).

3.4.3 Previous Investigations

An initial soil characterization program to determine the nature and extent of soil contamination was specified for the S&W Contractor Storage Yard in the Closure Plan for the Container Storage Facilities (Rockwell International et al., 1988b). Subsequent to submittal of the Closure Plan, soil samples were obtained in 1988 from the ten approximate locations shown on Figure 3-5 (Weston, 1988). Only 35 percent of the proposed soil samples were collected while awaiting final approval of the Closure Plan. One sample location was based on ground staining, five sample locations were based on historical use of the area, and four sample locations were based on the presence of hazardous waste in 1985. The soil samples were collected from 1 ft deep excavations and were composited over the 1 ft deep interval except for VOA samples which were grab samples from a depth of 1 ft. Analysis of soil samples included HSL VOAs, HSL BNAs, HSL metals, inorganics, and radionuclides. The laboratory results for these samples are not known to have been validated (Schoendaller, 1990). Prior to soil sampling, a visual and a direct radiation survey were also conducted to identify areas of potential contamination.

The HSL VOAs detected included acetone, chloroform, methylene chloride, toluene, and total xylenes. Methylene chloride was also detected in 33 percent of the blanks for the samples.

The HSL BNAs detected included anthracene, bis(2-ethylhexyl) phthalate, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, chrysene, di-n-butyl phthalate, fluoranthene, pentachlorophenol, phenanthrene, and pyrene. Bis(2-ethylhexyl)phthalate and di-n-butyl phthalate were also detected in the blanks as well as in the samples. All of the HSL VOAs and BNAs found except acetone were actually estimated values which were below the detection limits.

Because numerous HSL metals were detected, only metals detected above background levels established in the draft Phase III RI/FS Work Plan for the 881 Hillside Area (DOE, 1990) will be presented. Arsenic, cadmium, copper, lead, mercury, nickel, sodium, thallium, and zinc were detected at levels above background concentrations. Lead and mercury levels were elevated in several samples. No inorganics were detected above background concentrations. Radionuclides were detected at above background concentrations in nine out of ten samples. Americium-241 and plutonium-239 and -240 were the radionuclides detected at elevated levels ranging up to 16 and 47 times the background concentrations.

An area of soil staining was observed during the visual survey. However, during the soil sampling, it was noted that the stained area had been covered with new road base material. Road grading activity had disturbed the ground surface and no vegetation was present. No areas were determined to exceed background levels of gamma radiation during the FIDLER survey.

3.4.4 Conceptual Model

3.4.4.1 Contaminant Sources

Stored containers of waste oils and solvents that were removed in 1985 may be primary sources of contamination by volatile organics, polyaromatic hydrocarbons, and metals. Since only construction or maintenance-related materials were stored in SWMU 176, it is not likely that the waste containers were primary sources of plutonium and americium contamination. The wide spatial distribution of plutonium and americium across the Yard suggests windblown distribution of these radionuclides. The Solar Ponds are implicated as a source of americium and plutonium since they are located immediately upwind (to the west) of the SWMU 176.

3.4.4.2 Potential Exposure Pathways

Potential exposure pathways for contaminants associated with SWMU 176 include soil contamination, windblown dust or volatile emissions, storm water runoff, and infiltration to groundwater.

3.4.4.3 Potential Receptors

Potential receptors for contaminants could include human and terrestrial biota through dermal contact or ingestion of contaminated soils; human and terrestrial biota through inhalation of windblown dust; human, terrestrial and aquatic biota through ingestion or dermal contact with storm water runoffs; and human through ingestion or dermal contact with contaminated groundwater.

3.5 BUILDING 885 DRUM STORAGE AREA (SWMU 177)

The following discussion is summarized primarily from the Closure Plan for the Container Storage Facilities (Rockwell International et al., 1988b).

3.5.1 Location and Description

The Building 885 Drum Storage Area (SWMU 177) consists of the eastern and western sections of Building 885 (Figure 3-6). While the central section of Building 885 is completely enclosed, the eastern and western Drum Storage Areas are covered by a roof and are enclosed on two and three sides, respectively. The floor of the Drum Storage Areas are constructed of concrete, while the remaining area around Building 885 is covered with asphalt. Each Drum Storage Area is approximately 10 by 20 ft in size.

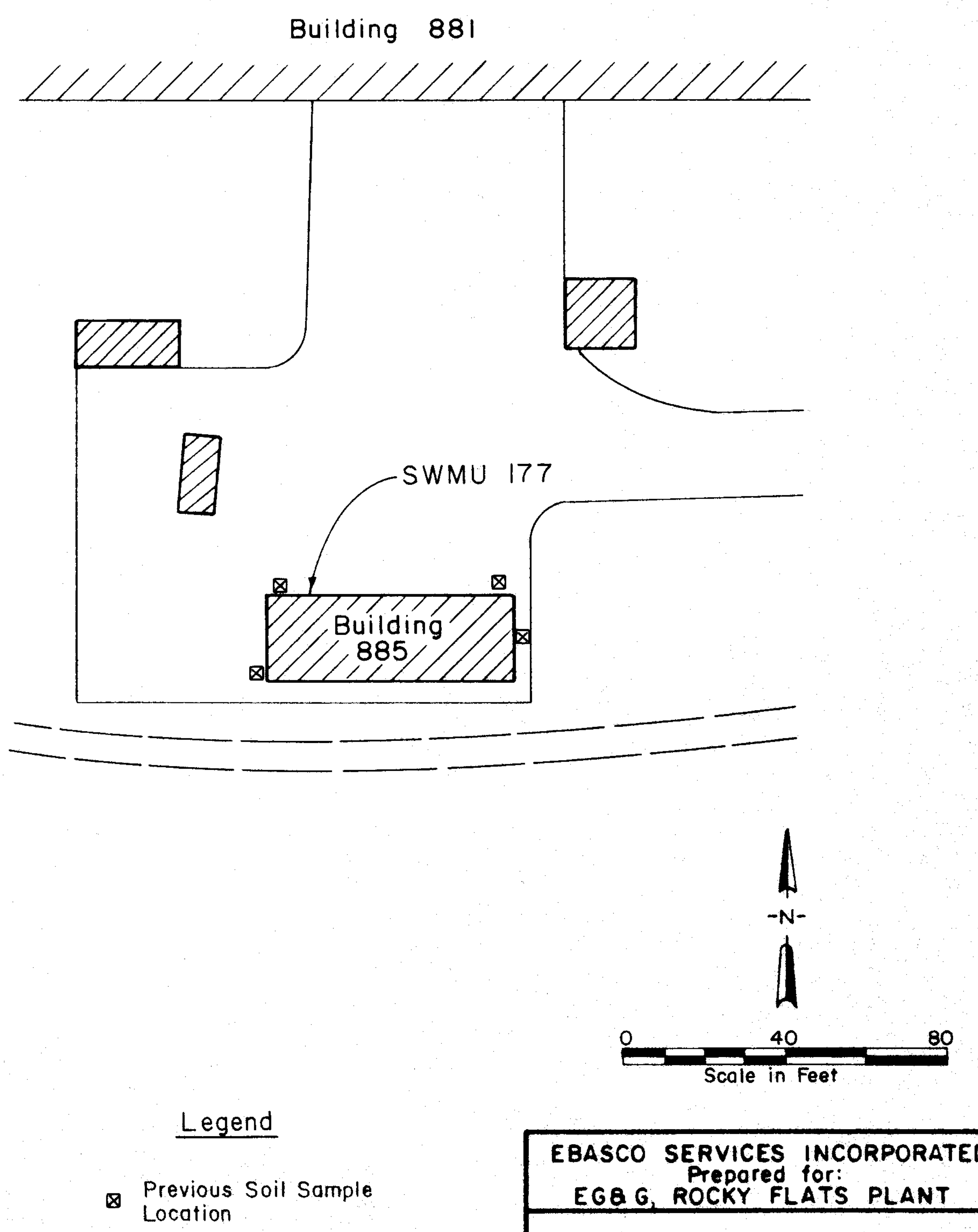

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FIGURE 3-6

Building 885 Drum Storage Area
(SWMU 177)

3.5.2 History

SWMU 177 has been used for drum storage since the mid-1950s. The Storage Areas have been used from 1986 to the present as an 90-day accumulation area and as a satellite collection station. The west section of Building 885 was used for storage of unused and waste oils, while the east section stored unused and waste paint and paint solvents. Waste material also contained low-level radioactive wastes. A maximum of 10 to 20 55-gallon drums were stored on pallets on the concrete floors in each area. Reportedly, only one drum in each section was used for waste storage, while the remaining drums contained unused oils and solvents. The total container storage capacity was 110 gallons, assuming only one drum in each of the two areas contained waste material. There have been no documented spills or leaks in this area.

3.5.3 Previous Investigations

An initial soil characterization program to determine the nature and extent of soil contamination was specified for the Building 885 Drum Storage Area in the Closure Plan for the Container Storage Facilities (Rockwell International et al., 1988b). Subsequent to submittal of the Closure Plan, soil samples were obtained in 1988 from the four approximate locations shown on Figure 3-6 (Weston, 1988). Only 40 percent of the proposed soil samples were collected while awaiting final approval of the Closure Plan. These samples were collected from 1 ft deep test pits located below 6 inch thick asphalt around the perimeter of the Drum Storage Area. Samples were composited over the test pit depth except for VOA samples which were grab samples from a depth of 1 ft. Analysis of soil samples included HSL VOAs, HSL BNAs, HSL metals, inorganics, and radionuclides. The laboratory results for these samples are not known to have been validated (Schoendaller, 1990). Prior to soil sampling, visual and direct radiation surveys were conducted to identify areas of potential contamination.

The HSL VOAs detected included acetone, chlorobenzene, ethylbenzene, tetrachloroethene, toluene, total xylenes, and 2-butanone. The HSL BNAs detected included anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(g,h,i)perylene, benzo(a)pyrene di-n-butyl phthalate, di-n-octyl phthalate, indeno(1,2,3-cd)pyrene, bis(2-ethylhexyl)phthalate, butyl benzyl phthalate, chrysene, fluoranthene, N-nitrosodiphenylamine, phenanthrene, and pyrene. Many of the HSL VOAs and BNAs found were actually estimated values which were below the detection limits. The BNA bis(2-ethylhexyl)phthalate was also detected in the blanks for the samples in which it was detected. Because numerous HSL metals were detected only metals detected above background levels established in the draft Phase III RI/FS Work Plan for the 881 Hillside Area (DOE, 1990) will be presented. Barium, calcium, copper, lead, magnesium, manganese, mercury, and zinc were detected at concentrations above background. The inorganics and radionuclides detected were not above background concentrations.

The visual survey of SWMU 177 indicated that the area was still in use for drum storage; however, no ground staining was observed. No areas were determined to exceed background levels of gamma radiation during prior FIDLER surveys.

However, ground staining was noted during an earlier visual survey in 1986. Whether the outside area was paved with asphalt at the time of the earlier inspection is unknown.

3.5.4 Conceptual Model

3.5.4.1 Contaminant Sources

Stored drums of oil, paints, and paint solvents may have been primary sources of contamination due to spills or leakage. The detection of polyaromatic hydrocarbons and volatile compounds such as acetone in the soil is consistent with releases of oils and solvents. However, ground stains were not observed during a site visit in May, 1990.

3.5.4.2 Potential Exposure Pathways

Potential exposure pathways for contaminants associated with SWMU 177 include soil, asphalt or concrete contamination; windblown dust or volatile emissions; stormwater runoff; and infiltration to groundwater.

3.5.4.3 Potential Receptors

Potential receptors for contaminants could include humans and terrestrial biota through dermal contact or ingestion of contaminated soil, asphalt or concrete; humans and terrestrial biota through inhalation of contaminated windblown dust or volatile emissions; humans, terrestrial and aquatic biota through ingestion or dermal contact with storm water runoff; and humans through ingestion or dermal contact with contaminated groundwater.

3.6 BUILDING 334 CARGO CONTAINER AREA (SWMU 181)

The following discussion is summarized primarily from the Closure Plan for the Container Storage Facilities (Rockwell International et al., 1988b).

3.6.1 Location and Description

The Building 334 Cargo Container Area (SWMU 181) was an 8 by 20 by 8 ft high steel Cargo Container that was used to store 55-gallon drums. The Cargo Container was reportedly located in the parking lot north of Building 334 (Figure 3-7). A maximum of 18 55-gallon drums could be stored in the Container; however, reportedly seven drums were the maximum placed in the Container. The maximum storage capacity was therefore 385 gallons. The Cargo Container was located on an asphalt pad, and a collection pan was located in the bottom of the Cargo Container for secondary containment.

3.6.2 History

This area was used from the summer of 1984 to July 1986 for storage of drums containing waste machine oils, solvents, and machine coolants, and possibly low-level radioactive wastes. There is no documented or visual evidence of spills or leakage from the drums in the Cargo Container. The Cargo Container was moved to the Building 444/453 Drum Storage Area (Section 3.7) (SWMU 182).

3.6.3 Previous Investigations

Reportedly, no previous investigations of the Building 334 Cargo Container area have been conducted.

3.6.4 Conceptual Model

3.6.4.1 Contaminant Sources

Drums containing waste oils, solvents, coolants, and possibly low-level radioactive wastes may have been primary sources of contamination of the asphalt and underlying soil.

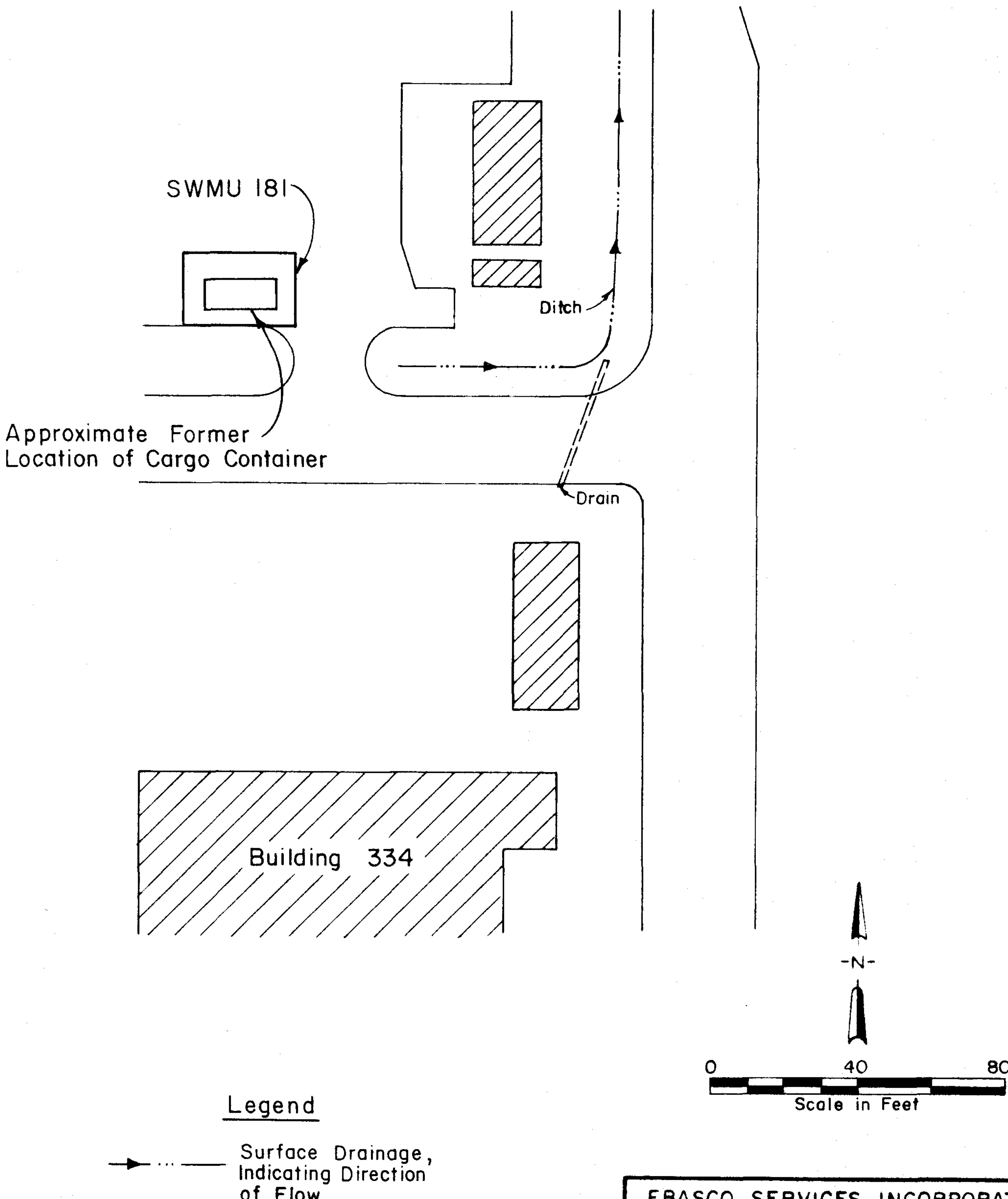

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FIGURE 3-7

Building 334 Cargo Container Area (SWMU 181)

However, there is no documented or visual evidence of releases from the drums, and the Cargo Container provided secondary containment of releases in the event that they had occurred. The Cargo Container and associated drums have since been removed.

3.6.4.2 Potential Exposure Pathways

Potential exposure pathways for contaminants associated with SWMU 181 include soil contamination; windblown dust or volatile emissions; storm water runoff; and infiltration to groundwater.

3.6.4.3 Potential Receptors

Potential receptors for contaminants could include humans and terrestrial biota through dermal contact or ingestion of contaminated soil, asphalt or concrete; humans and terrestrial biota through inhalation of contaminated windblown dust or volatile emissions; humans, terrestrial and aquatic biota through ingestion or dermal contact with storm water runoff; and humans through ingestion or dermal contact with contaminated groundwater.

3.7 BUILDING 444/453 DRUM STORAGE AREA (SWMU 182)

The following discussion is summarized primarily from the Closure Plan for the Container Storage Facilities (Rockwell International et al., 1988b).

3.7.1 Location and Description

The Building 444/453 Drum Storage Area (SWMU 182) is located between Buildings 444 and 453 and covers an area of approximately 1,700 square ft (Figure 3-8). In the mid-1970s, the Drum Storage Area was covered with 4 inches of asphalt. There are no berms around the area.

3.7.2 History

The Building 444/453 Drum Storage Area was first used when the two buildings were constructed in the late-1960's and storage continued until the fall of 1986. Originally, 55-gallon drums were placed directly on the ground surface. In the mid-1970s, the top 4 inches of soil in a portion of the Drum Storage Area believed to be contaminated was

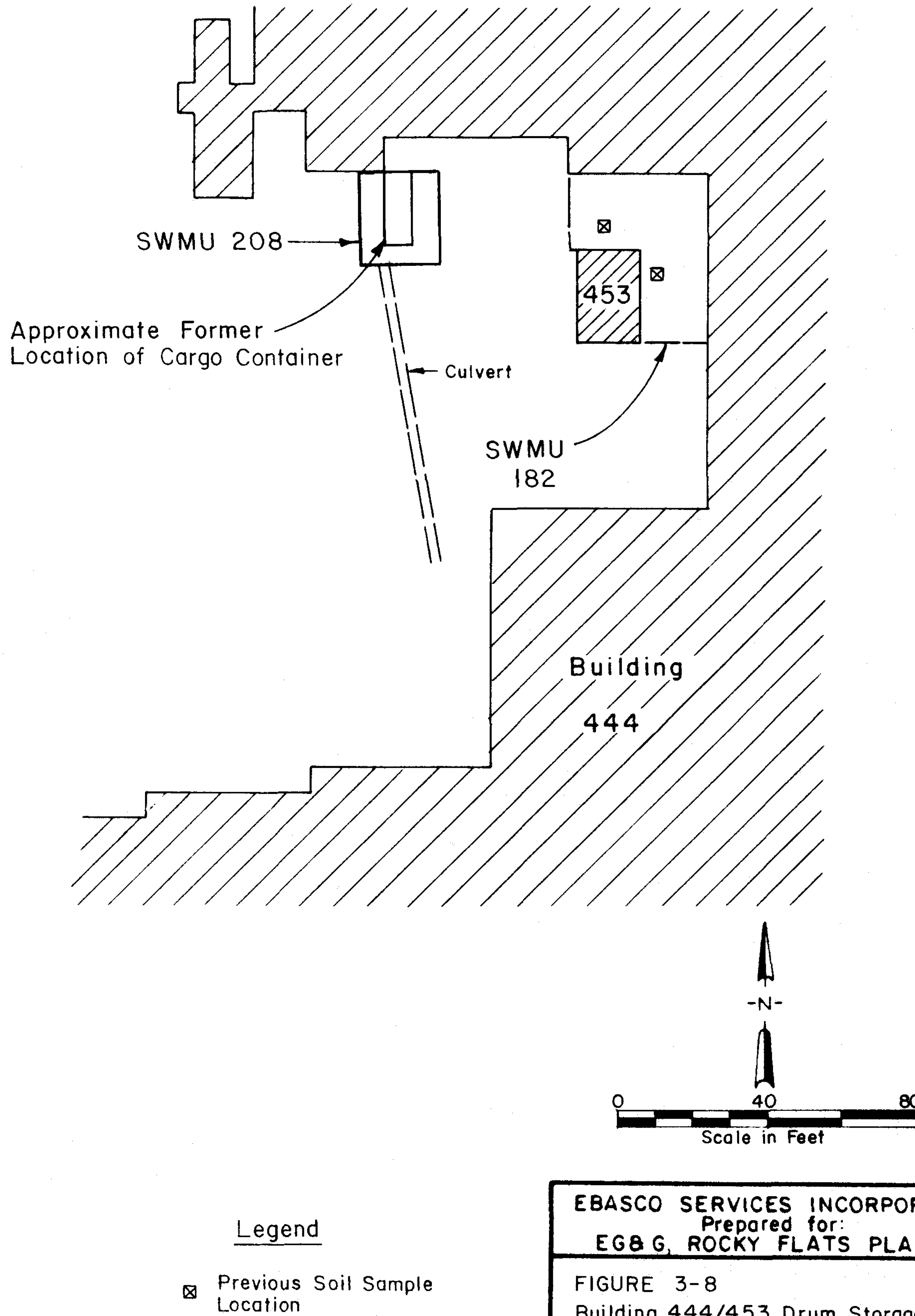

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FIGURE 3-8
Building 444/453 Drum Storage Area (SWMU 182) and Inactive 444/447 Waste Storage Area (SWMU 208)

removed and replaced with 4 inches of asphalt. Drums were still stored on the soil in the remaining portion of the Drum Storage Area.

The maximum number of drums ever stored at one time was approximately 200; however, some of these drums contained unused oil. The exact number of drums containing contaminated waste oils or solvents is unknown. Based on storage of 200 55-gallon drums, the total container storage capacity at any given time was 11,000 gallons. Waste hydraulic oils and chlorinated solvents were stored in the 55-gallon drums. Beryllium and low-level uranium contamination were sometimes present in the waste. The Drum Storage Area is roped off and is generally empty, although trash, such as wood, is sometimes temporarily placed in the roped off area.

The Building 334 Cargo Container was reportedly moved and relocated adjacent to the Storage Area in the fall of 1986. This Cargo Container was moved out of the Storage Area to the main hazardous waste storage area identified as Unit #1 in the RCRA Part B Permit Application (Rockwell International et al., 1987).

During a site visit in May 1990, no drums of waste oil or solvents were observed in the Storage Area. Soil staining, apparently due to spillage of oils, was generally present throughout the Storage Area.

3.7.3 Previous Investigations

An initial soil characterization program to determine the nature and extent of soil contamination was specified for the Building 444/453 Drum Storage Area in the Closure Plan for the Container Storage Facilities (Rockwell International et al., 1988b). Subsequent to submittal of the Closure Plan, soil samples were obtained in 1988 from the approximate locations shown on Figure 3-8 (Weston, 1988). Only 67 percent of the proposed samples were collected while awaiting final approval of the Closure Plan. These samples were collected from 1 ft deep excavations below the concrete sidewalk and were composited over the 1 ft deep interval except for VOA samples which were grab samples from a depth of 1 ft.

Prior to soil sampling, a visual and direct radiation survey were also conducted to identify areas of potential contamination. These surveys were conducted to identify areas of stratified sampling as previously described in Section 3.2.3.

The samples were reportedly analyzed for HSL VOAs, BNAs, HSL metals, inorganics and radionuclides; however, the analytical results for HSL VOAs are currently unavailable. The laboratory results for these samples are not known to have been validated (Schoendaller, 1990).

The HSL semivolatile detected included acenaphthene, anthracene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(g,h,i)perylene, benzo(a)pyrene, bis(2-ethylhexyl)phthalate, dibenzofuran, dibenz(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-cd) pyrene naphthalene, pyrene, and 2-methylnaphthalene. Many of the HSL BNAs found were actually estimated values which were below the detection limits. Because numerous HSL metals were detected only metals detected above background levels established in the draft Phase III RI/FS Work Plan for the 881 Hillside Area (DOE, 1990) will be presented. Cadmium, copper, and zinc were detected at concentrations above background. No inorganics were detected above background concentrations. Uranium-238 was detected in one sample at levels of approximately four times background concentrations.

During the visual survey of SWMU 182 extensive staining of the asphalt pad was noted. No staining was observed along the concrete sidewalk. Above background levels of radiation were detected during the FIDLER survey. Background was determined to be 250 counts per minute (cpm).

Above background levels ranging form 500-2,500 cpm were detected from the asphalt areas. Additionally, readings ranging from 750-1,000 cpm were detected along the buildings and the cracks between the concrete. Readings from the concrete sidewalk area were at the background limit of 250 cpm. The FIDLER survey is reportedly only effective to depths of 2-3 inches and may not be indicative of the radiation levels in soil beneath the asphalt.

3.7.4 Conceptual Model

3.7.4.1 Contaminant Sources

A primary source of contamination may have been the storage of drums containing contaminated oils and solvents directly on the ground surface and on an asphalt covered area. The prevalence of soil staining indicates potential contamination.

Radiation surveys indicate above background levels of ionizing radiation. Stored materials included waste hydraulic oils and chlorinated solvents, some of which were contaminated with beryllium and low-level uranium. The potential also exists for the presence of other heavy metal constituents.

3.7.4.2 Potential Exposure Pathways

Potential exposure pathways for contaminants associated with Building 444/453 Drum Storage Area would include soil contamination; windblown dust or volatile emissions; surface water and sediment runoff; and infiltration to groundwater.

3.7.4.3 Potential Receptors

Potential receptors for contamination could include humans and terrestrial biota through dermal contact with soil; humans and terrestrial biota through inhalation of dust or volatile emissions; humans, terrestrial and aquatic biota through ingestion and dermal contact with surface water and sediments; and humans through ingestion, inhalation, and dermal contact with groundwater.

3.8 BUILDING 460 SUMP # 3 ACID SIDE (SWMU 205)

The following discussion is summarized primarily from the Closure Plan for the Building 460 Acid and Solvent Dumpsters (Advanced Sciences, Inc., 1988).

3.8.1 Location and Description

The Building 460 Sump #3 Acid Side (SWMU 205) is located in room 156B of Building 460 (Figure 3-9). Lines run from the waste generators to the Acid Sump and from there through the concrete wall to dumpsters (liquid waste tanks) where the lines are attached by quick connect couplings. The Acid Sump, a fiberglass tank, is served by a pump to

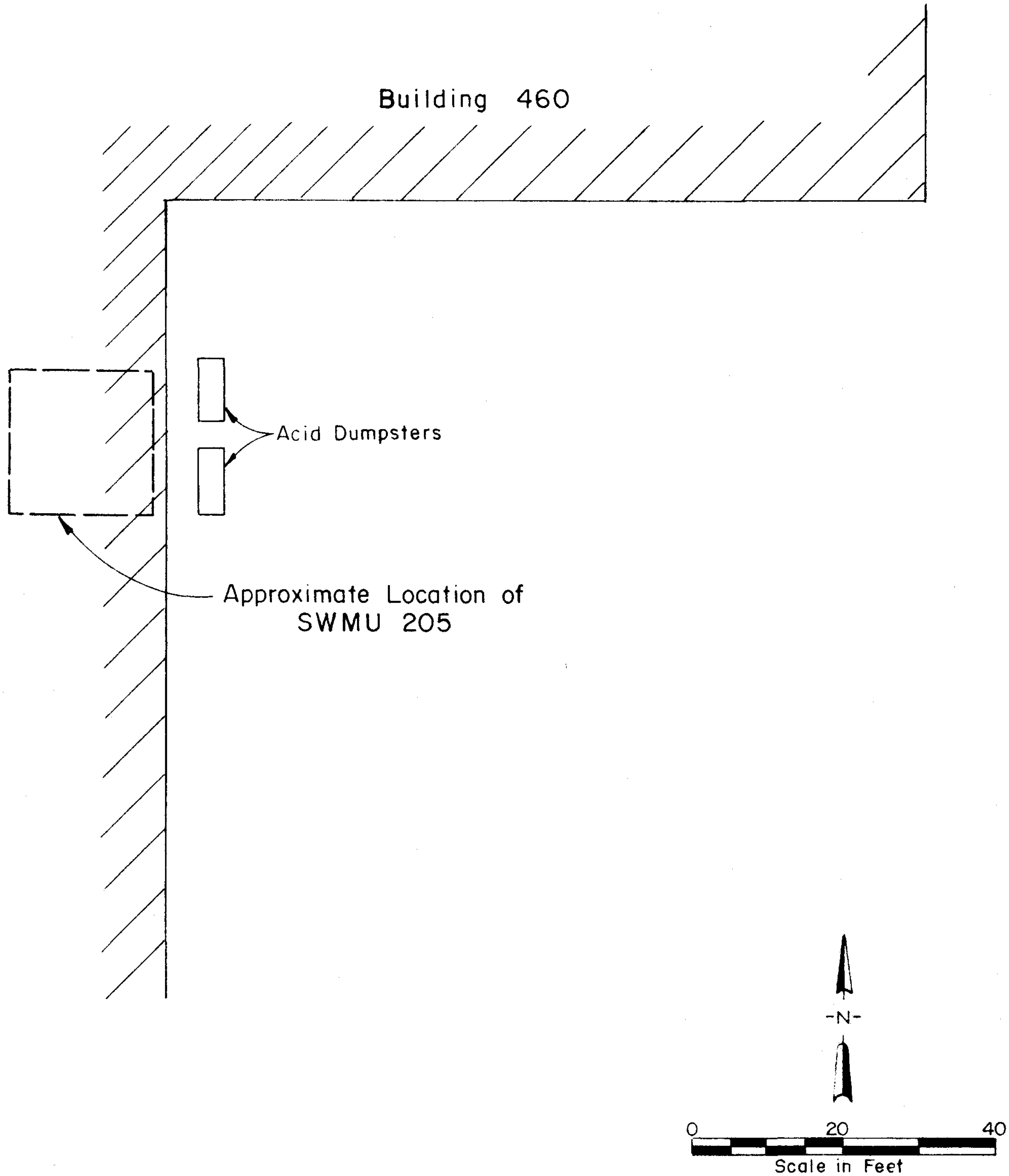

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FIGURE 3-9

Building 460 Sump # 3 Acid Side
(SWMU 205)

transfer waste acid from the Sump through a dedicated pipe system to the acid waste dumpsters. The Acid Sump is connected to the Building 460 dedicated drainage system (exclusively acids). The Acid Sump, a 15-gallon solvent holding tank, and transfer lines occupy approximately 40 square ft. A separate volume and area for the Acid Sump was not included in the relevant closure plan.

Waste materials handled by the Acid Sump were a mixture of approximately 80 percent water and 20 percent acid. The acids were primarily nitric acid and Nitradd, a combination of hydrofluoric acid and ammonium salts.

3.8.2 History

Building 460, the Consolidated Non-Nuclear Manufacturing Building, contains 25 major functions/operations:

Electric Discharge Machining	Copper Cleaning
Acid Cleaning - Automated line	Aqueous Cleaning
Acid Cleaning - Internal line	Inspection
Electro-Chemical Machining	R and D Lab
Final Step-Cleaning	Machinery
Nondestructive Testing	Assembly Machining
Hardware Machining	Assembly
R and D Shop	Maintenance Paint Shop (2)
Maintenance Machine Shop	Maintenance Pipe Shop
Crush Grinding Operation	Lube Oil Storage
Maintenance Sheet Metal Shop	Production Testing Cells
Maintenance Carpenter Shop	Metallography Lab

Acid waste from these operations flow through the Acid Sump en route to dumpsters. The Acid Sump was still in use as of October 1988. The fiberglass tank functioning as the Acid Sump is located on a concrete floor in room 156B (Bldg. 460). There have been no reports of Sump leakage.

3.8.3 Previous Investigations

Reportedly, no previous investigations regarding the Acid Sump have been conducted.

3.8.4 Conceptual Model

3.8.4.1 Contaminant Sources

The potential exists for leakage of acid waste from failure or cracking of the fiberglass Acid Sump or leakage associated with piping and fillings bringing waste to the sump and from the Sump to the dumpsters. Leaked materials would consist of approximately 80 percent water and 20 percent acid composed of nitric acid and Nitradd, a combination of hydrofluoric acid and ammonium salts.

3.8.4.2 Potential Exposure Pathways

A leak from the Acid Sump would be initially contained by the concrete floor of Building 460. Assuming the existence of cracks in the floor, acid waste could contaminate soil and groundwater beneath the building. There have been no reports of leakage or cracks in the floor supporting the Acid Sump.

3.8.4.3 Potential Receptors

Assuming a leak within the room containing the Acid Sump, potential receptors for contamination would be employees of the building through dermal and inhalation contact with the waste. Leakage through the floor into groundwater could result in human exposure through ingestion and dermal contact.

3.9 INACTIVE D-836 HAZARDOUS WASTE TANK (SWMU 206)

The following discussion is summarized primarily from the RCRA Part B Permit Application (Rockwell International et al., 1987).

3.9.1 Location and Description

The Inactive D-836 Hazardous Waste Tank (SWMU 206) was previously identified in the RCRA Part B Permit Application (Rockwell International et al., 1987) as Unit # 41.14, a portion of the Building 374 Waste Treatment Facility (Unit #42). Although the D-836 Hazardous Waste Tank was mobile, the area considered for the scope of this Work Plan is the area outside Building 374 where this Tank was connected to the building (Figure 3-10). The Tank is constructed of carbon steel and is 8 ft in diameter by 49.5 ft in length with a total storage capacity of 19,000 gallons.

3.9.2 History

The Inactive D-836 Hazardous Waste Tank was constructed in 1962. From 1975 to 1987 the Tank was used to store off-specification Building 374 Product Water (water too high in conductivity). The Tank was a portion of the Building 374 Waste Treatment Facility. Reportedly no spills or leaks from the Tank have occurred (Cypher, 1990). The Tank was located over compacted soil outside of Building 374 and was not secondarily contained. Prior to 1975, the Tank was probably used to store Air Force fuel at another location.

3.9.3 Previous Investigations

Reportedly, previous soil sampling investigations have not been conducted at this site.

3.9.4 Conceptual Model

3.9.4.1 Contaminant Sources

The potential contaminant source at this site is the potentially contaminated soil underneath the area where the Tank and the associated pipes connecting the Tank to Building 374 were previously located. If any spills or leaks occurred in this area, the potential contaminants would consist primarily of elevated nitrates from the off-specification Building 374 Product Water (Cypher, 1990).

3.9.4.2 Potential Exposure Pathways

Potential exposure pathways may include soil contamination; windblown dust or volatile emissions; surface water runoff; and infiltration to groundwater. Precipitation resulting in infiltration would be the mechanism by which groundwater may be contaminated. In addition, surface water runoff terminating in a surface water body may result in its contamination.

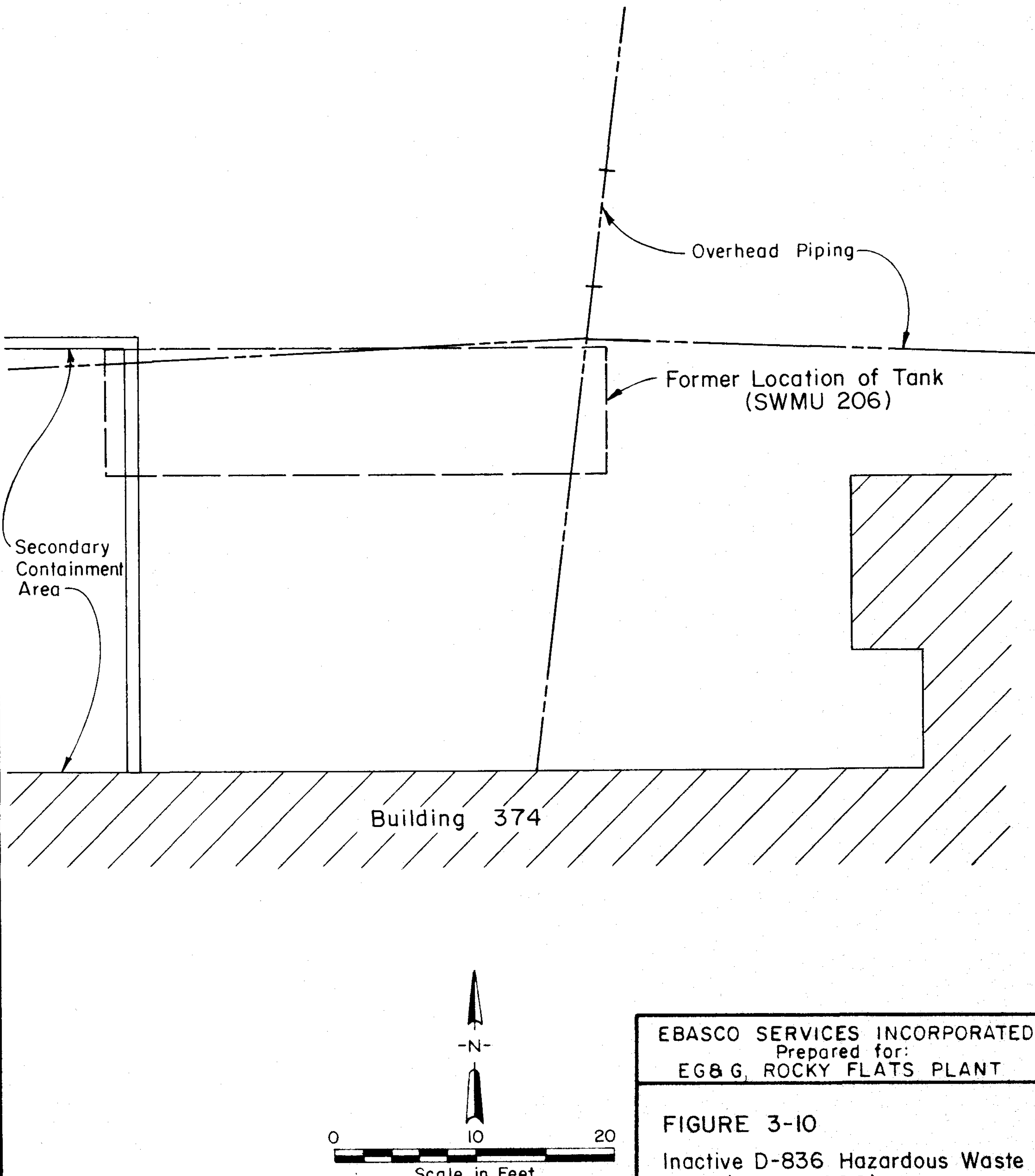

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FIGURE 3-10

Inactive D-836 Hazardous Waste Tank (SWMU 206)

3.9.4.3 Potential Receptors

Potential receptors may include humans and terrestrial biota through dermal contact with soil; humans and terrestrial biota through inhalation of dust or volatile emissions; humans through ingestion, inhalation, and dermal contact with groundwater; and humans, and terrestrial and aquatic biota through ingestion and dermal contact with surface water and sediments.

3.10 INACTIVE BUILDING 444 ACID DUMPSTERS (SWMU 207)

The following discussion is summarized primarily from the Closure Plan for the Building 444 Acid Dumpsters (Rockwell International et al., 1988c).

3.10.1 Location and Description

The Inactive Building 444 Acid Dumpsters (SWMU 207) were located outside and to the east of Building 444 (Figure 3-11). The Stainless Steel Acid Dumpsters were located within a bermed area with inner dimensions measuring 9.5 ft wide by 9 ft long by 1 ft high. The bermed area had the capacity to contain 640 gallons. Although the bermed area had the capacity to store two 500-gallon dumpsters, only one dumpster was filled at a time.

3.10.2 History

The Acid Dumpsters were used to store acidic wastes from Building 444 and operated from 1980 through 1987. When one dumpster was full it was transported to Building 374 or 774 for treatment and the other dumpster was subsequently used for waste storage. The waste consisted of acidic waste from the chemical milling of beryllium and electropolishing solution from chemical milling. The raw milling acid consisted of a mixture of 75 percent phosphoric acid, 3 percent sulfuric acid, and chromium trioxide. The electropolishing solution consisted of phosphoric acid. The spent acid was drained into a sump and then into the Dumpsters. There were no reports of spills from the Dumpsters. The bermed area was inspected frequently. The Dumpsters and associated piping were decontaminated and moved to another process area during 1987. During a site visit in May 1990, it was noted that although the bermed area was still intact some concrete degradation has occurred.

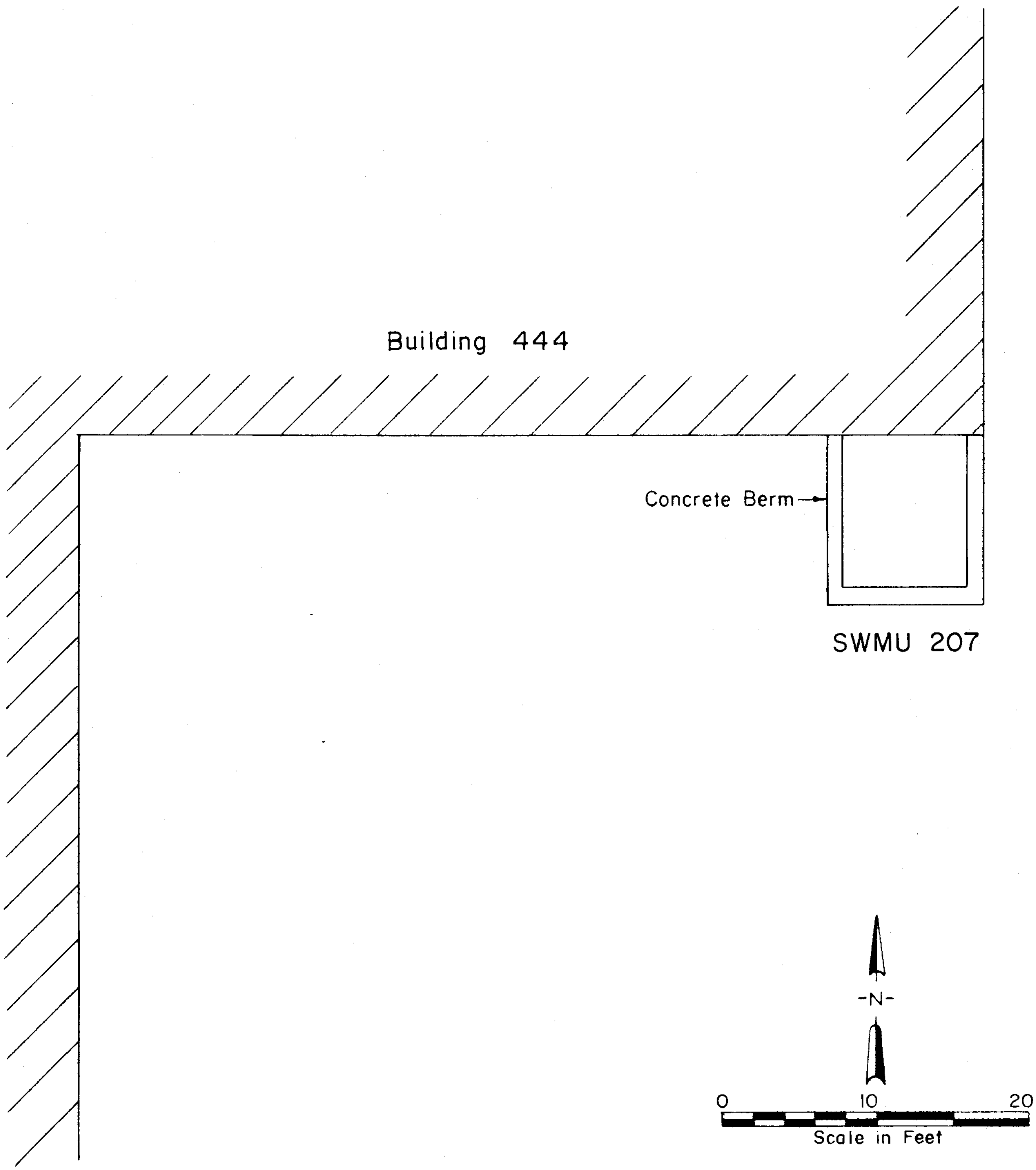

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FIGURE 3-11

Inactive Building 444 Acid Dumpsters (SWMU 207)

3.10.3 Previous Investigations

Reportedly, no previous soil sampling investigations have been performed. Analysis of grab samples of the waste inputs (waste acid and electropolishing solution) to the Acid Dumpsters was conducted in February, 1987. The EP toxic metals arsenic, cadmium, chromium, lead, and silver were determined to exceed the EP toxicity limits. The wastes also exceeded the limit for corrosivity (pH < 2.0).

3.10.4 Conceptual Model

3.10.4.1 Contaminant Sources

A potential source for contamination would have been unidentified leaks or spills from the Acid Dumpsters. The spilled waste could be composed of phosphoric acid and sulfuric acid, chromium trioxide, and metals, and would have the potential of leaking through the bermed area through potentially degraded concrete.

3.10.4.2 Potential Exposure Pathways

Potential exposure pathways for waste acid spills would be through the air by windblown dust or volatile emissions, contaminated soil, and groundwater by infiltration and percolation.

3.10.4.3 Potential Receptors

Potential receptors would be humans and terrestrial biota through inhalation of windblown dust or volatile emissions; humans through dermal contact with contaminated concrete or soil; and humans through ingestion and dermal contact with contaminated groundwater.

3.11 INACTIVE 444/447 HAZARDOUS WASTE STORAGE AREA (SWMU 208)

The following discussion is summarized primarily from the RCRA Part B Permit Application (Rockwell International et al., 1987).

3.11.1 Location and Description

The Inactive 444/447 Hazardous Waste Storage Area (SWMU 208) was previously identified in the RCRA Part B Permit Application (Rockwell International et al., 1987) as Unit #3 and was reportedly located in the same area as SWMU 182 (Figure 3-8). This

Storage Area consisted of a 20 ft by 8 ft cargo container with a maximum waste volume of 990 gallons. Similar to the Inactive D-836 Hazardous Waste Tank, this Storage Area was also mobile and is currently used to store hazardous waste at Unit #1 (Hazardous Waste Storage Area) (Rockwell International et al., 1987). However, only the location at SWMU 182 will be considered for this Work Plan.

3.11.2 History

The following history is summarized from the RCRA Part B Permit Application (U.S. DOE, 1986). The Inactive 444/447 Hazardous Waste Storage Area was used from 1986 to 1987 at Unit #3, which was located at the same point as SWMU 182. This Storage Area was secondarily contained, and reportedly no leaks or spills occurred in this area. Typical wastes stored in this Storage Area included a composite of nitric acid with silver, sodium fluoride, NaF solution, plating acids (HCl, HNO_3, and HF) with concentrated chromium plating solution, concentrated cadmium cyanide solution, nickel sulfamate, and developer/fixer.

Some confusion exists as to the location and existence of SWMU 208. A site visit in May 1990 failed to determine the location of the mobile Storage Unit. EG&G personnel have stated that the Storage Area never existed beyond early planning stages (Church, 1990).

3.11.3 Previous Investigations

Reportedly, previous soil sampling investigations have not been conducted at this site.

3.11.4 Conceptual Model

3.11.4.1 Contaminant Sources

The potential contaminant source at this site is the potentially contaminated soil underneath the location where the Storage Area was previously located. Potential contaminants would consist of the typical wastes stored in the Cargo Container if any leaks or spills occurred. These wastes included a composite of nitric acid with silver, NaF solution, plating acids (HCL, HNO_3, and HF) with concentrated chromium plating solution, concentrated cadmium cyanide solution, nickel sulfamate, and developer/fixer.

3.11.4.2 Potential Exposure Pathways

Potential exposure pathways may include soil contamination; infiltration to groundwater; stormwater runoff; and windblown dust. Surface water runoff terminating in a surface water body may result in its contamination. In addition, precipitation resulting in infiltration would be the mechanism for groundwater contamination.

3.11.4.3 Potential Receptors

Potential receptors may include humans and terrestrial biota through dermal contact with soil; human through ingestion, inhalation, and dermal contact with groundwater; humans, and terrestrial and aquatic biota through ingestion and dermal contact with surface water and sediments; and humans, and terrestrial biota through inhalation of dust.

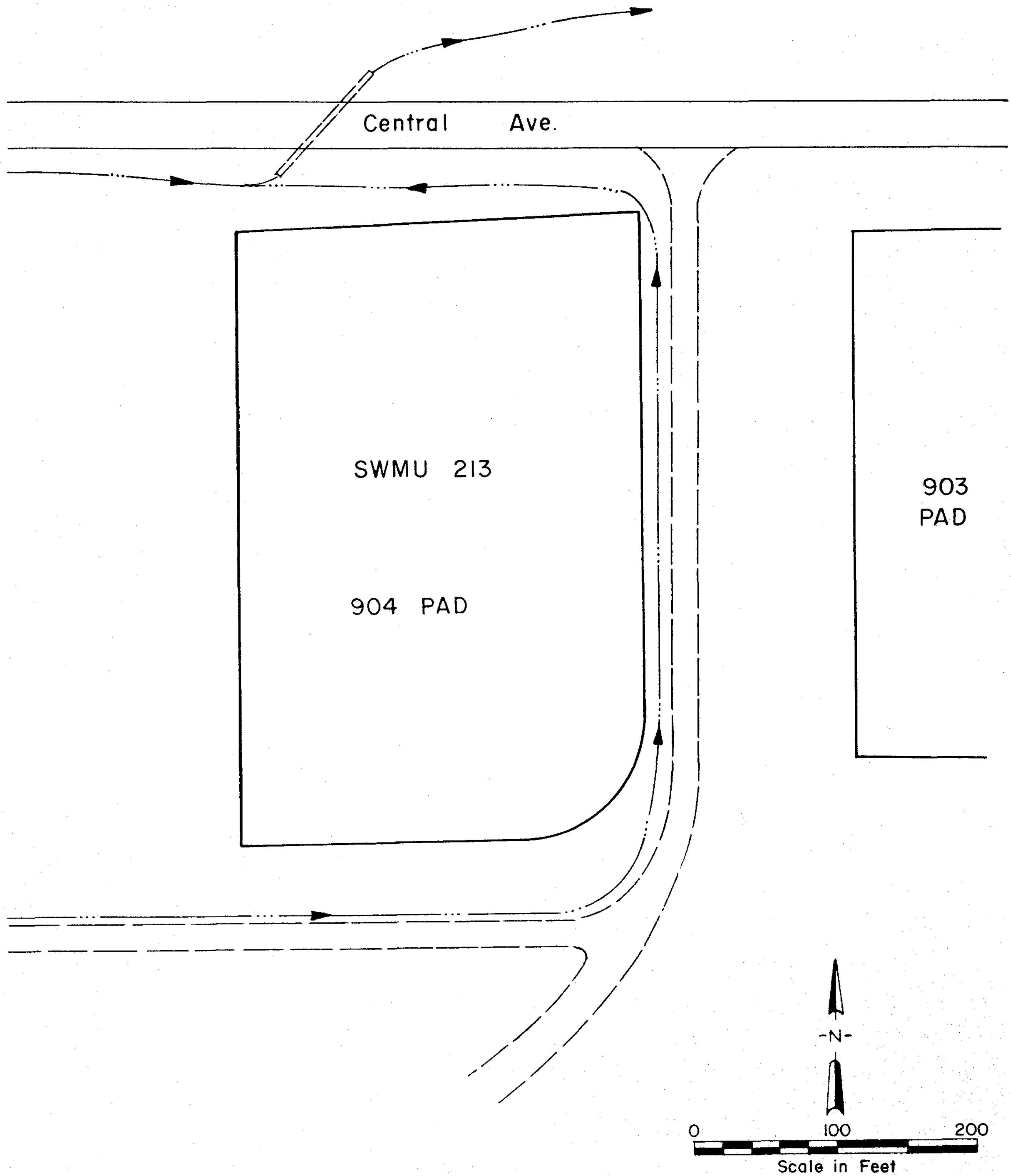
3.12 UNIT 15, 904 PAD PONDCRETE STORAGE (SWMU 213)

The following discussion is summarized primarily from the Closure Plan for Unit 15, Storage Pad 904 (Rockwell International et al., 1989d).

3.12.1 Location and Description

The Unit 15, 904 Pad Pondcrete Storage (SWMU 213) is located in the southeastern portion of the plant production area and occupies a 129,505 square ft rectangular area measuring 439 ft north-south and 295 ft east-west (Figure 3-12). The Pad slopes approximately 0.7 percent to the northeast with runoff or berm overtopping being intercepted by a north draining ditch. The west, north, and east perimeters of the 904 Pad, Area A, are enclosed by a 6 inch high berm added approximately one year after storage began on the Pad. The berm was designed to collect surface water runoff samples from the Pad.

The Pad is used for the storage of pondcrete, a low-level mixed waste resulting from the solidification of Solar Pond sludge or sediment with Portland cement. The material is placed in polyethylene lined 3/4 inch plywood boxes measuring 4 ft by 2 1/2 ft by 7 ft. Boxes are stacked three high on the Pad. Metal boxes measuring 4 ft by 4 ft by 7 ft are also used. Saltcrete, a material similar in nature to pondcrete resulting from evaporation of liquid process waste, is treated and stored in the same fashion as pondcrete on the Pad. Pondcrete and saltcrete are stored within the berm area of the Pad.



Legend

Surface Drainage

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FIGURE 3-12

Unit 15, 904 Pad Pondcrete Storage (SWMU 213)

The maximum pondcrete and saltcrete storage capacity of the 904 Pad, Area A, is 6,136 wooden and 102 metal boxes of waste, accounting for approximately 103,464 cubic ft of waste (5,000 tons, assuming density of 100 pounds per cubic ft). Pad 904 is at maximum capacity. Materials will be removed from the pad by October 1991.

3.12.2 History

The 904 Pad was constructed in August 1987 of 3 inches thick hot bituminous pavement placed over 6 inches of Class 6 coarse aggregate on regraded native soil. The 904 Pad was located adjacent to the 903 Pad, the largest source of plutonium release to the environment at the Rocky Flats Plant. Prior to construction, soil samples to a depth of approximately 2 inches were collected and analyzed. Plutonium-239 concentrations were generally above fallout levels indicating some plutonium contamination was present at the 904 Pad location prior to construction. After the removal of vegetation and the top 6 to 12 inches of soil during pad construction, the area was resampled. Plutonium-239 concentrations were found to be more than an order of magnitude higher than the previous shallow samples. These sampling results indicated that relatively clean soil material has been laid down over previously contaminated soil material in the area of the 904 Pad. It was reported that covering plutonium-contaminated soils with clean soils was a practice at the Rocky Flats Plant during the late 1960s and early 1970s. Excavated contaminated material was stock piled along the west border of the 904 Pad, covered with clean soil, and vegetated to prevent wind dispersal.

The 904 Pad began receiving waste during October 1987. The initial pad was not constructed with a containment berm. Pondcrete accumulation on the 904 Pad was temporarily halted in May 1988 as the result of a spill on the Pad. On June 6, 1988, a 6 inch high asphalt berm was constructed around the west, north, and east perimeter of the 904 Pad in an attempt to collect surface water runoff samples from the Pad area. Spills and leakage of both pondcrete and saltcrete have been a recurrent problem throughout the operations of the 904 Pad. A number of incidences are related to the incomplete solidification of the waste material and resulting failure of the container with releases to the Pad surface. Spills of pondcrete are cleaned by washing the pad surface with water using brooms to remove contaminants from crevices in the asphalt. Water is collected using a wet vacuum cleaner. The cleaning process is continued until radiation levels are below the detection limit for the monitoring instrument. Saltcrete spills tend to be composed of dry material which is cleaned by vacuuming until radiation levels are below the detection limit for the monitoring instrument. Portable air monitors have been moved to the pad shortly after spill incidence. Based on these monitors, there have been no releases that exceed the Plant Screening Guide for plutonium in air of 0.01 pCi/m^3.

3.12.3 Previous Investigations

Soil sampling prior to and during grading activities associated with the 904 Pad construction have documented pre-existing radioactive contamination. Samples of runoff water from the 904 Pad taken after spills have detected gross alpha and beta concentrations above drinking water standards. Seepage of runoff water below the asphalt berm has been reported as very common by Plant employees. Analysis of runoff data indicates 41 percent of all runoff samples equal or exceed the gross alpha drinking water standard of 15 pCi/L and 37 percent of all runoff samples are equal to or exceed the gross beta drinking water standards of 50 pCi/L. Analysis of existing data indicates that runoff from the 904 Pad may be contributing to the elevated analyte concentrations in the South Walnut Creek water. South Walnut Creek is diverted into Pond B-4 which intermittently discharges to Pond B-5, the last control point on the South Walnut Creek drainage. Pond B-5 discharges must meet the NPDES Permit for the Rocky Flats Plant.

A memo dated January 26, 1989, 89-RF-0332, addresses the possible impact of runoff from Pad 904 and Pad 750. The runoff may result in chronic low levels of contaminants being contributed by these pads that could eventually reach levels in Pond B-5 such that discharge from the pond would violate the NPDES permit. The potential for contamination thus exists along the path from Pad 904 to Pond B-5.

3.12.4 Conceptual Model

3.12.4.1 Contaminant Sources

Construction of the 904 Pad disturbed contaminated materials present at the site. Chronic spillage has occurred throughout the life of the 904 Pad involving pondcrete and saltcrete, which are both mixed waste. Contaminated runoff from the pad has underflowed and overflowed the berm and been transported through a north draining ditch through South Walnut Creek, Pond B-4, and into Pond B-5. A wide range of contaminants are associated with the stored mixed waste. Indicator parameters including plutonium-239 and -240, americium-241, and nitrate have been detected along with elevated levels of gross alpha and gross beta radiation.

3.12.4.2 Potential Exposure Pathways

Spills of poorly solidified pondcrete can provide exposure pathways through stormwater runoff, carrying contaminated water and sediment. Storm water runoff may terminate in surface water bodies or infiltrate to groundwater. Infiltration and percolation can contaminate the asphalt Pad and underlying soils which have been previously contaminated from other operations. Contaminated dust on the pad can be transported through wind action.

Dry materials from saltcrete spillage can be moved by wind action. Streams and lakes in the vicinity can be affected by wind, surface, and groundwater transportation. Runoff overtopping and underflowing of the berm can transport fine-grained contaminated material.

3.12.4.3 Potential Receptors

Potential receptors include humans for all potential exposure pathways identified. Terrestrial biota are potential receptors for inhalation of windborne contaminants and ingestion, and dermal contact with surface water. Aquatic biota are also potential receptors of surface water contamination through ingestion and dermal contact.

3.13 UNIT 25, 750 PAD PONDCRETE AND SALTCRETE STORAGE (SWMU 214)

The following discussion is summarized primarily from the Closure Plan for Unit 25, Storage Pad 750 (Rockwell International et al., 1989e).

3.13.1 Location and Description

The Unit 25, 750 Pad Pondcrete and Saltcrete Storage (SWMU 214) Pad 750 was initially constructed as a parking lot for Building 750 (Figure 3-13). One hundred forty-two thousand square ft of the original 220,000 square ft surface are used for storage. The 750

Pad consists of asphalt located approximately at grade, sloped 2 percent to the east. Prior to storage of waste material, an overlay was installed consisting of 3 inches of asphalt underlain by Petromat, a rubberized material intended to prevent permeation through the Pad. An 8 inch high asphalt berm was added to the east and portions of the north and south sides to minimize runon and provide runoff water samples from the Pad. Runoff from the 750 Pad is collected in seven stormwater inlets between 10th Street and the 750 Pad. All runoff water storage behind the 8 inch berm occurs in the immediate vicinity of the stormwater inlets. Calculated storage potential behind the berm is approximately 500 cubic ft. Any precipitation event that exceeds approximately 0.03 inches will cause overlapping of the berms. The stormwater inlets are directly piped to culvert which drains to South Walnut Creek.

The Pad is used for the storage of pondcrete, a low-level mixed waste resulting from the solidification of Solar Pond sludge or sediment with Portland cement. The material is placed in polyethylene-lined 3/4 inch plywood boxes measuring 4 ft by 2.5 ft by 7 ft. Boxes are stacked three high on the Pad. Metal boxes measuring 4 ft by 4 ft by 7 ft are also used. Saltcrete, a material similar in nature to pondcrete resulting from evaporation of liquid process waste, is treated and stored in the same fashion as pondcrete on the pond. Pondcrete and saltcrete are stored within the berm area of the Pad.

The maximum waste storage inventory of the 750 Pad is 12,168 boxes of waste, accounting for approximately 183,000 cubic feet of waste (9,000 tons, assuming a density of 100 pounds per cubic foot). The inventory as of September 30, 1989 consisted of 8,881 wooden boxes of pondcrete, 157 metal boxes of pondcrete, and 855 wooden boxes of saltcrete.

3.13.2 <u>History</u>

The 750 Pad was initially constructed as a 220,000 square ft parking lot for Building 750 in 1969. The Pad was constructed with 6 inch thick aggregate overlain by a 2 inch thick asphaltic concrete parking. In 1986, prior to the storage of waste, 142,000 square ft of the Pad was overlaid with Petromat and 3 inches of asphalt. Eight inch high asphalt berms were constructed along the east and portions of the north and south sides. Waste storage began on November 18, 1986.

Production of pondcrete ceased on May 23, 1988 in response to spills on the 904 Pad. A detailed inspection of waste stored on the 750 Pad identified approximately five percent (440) of pondcrete boxes to be of poor quality (i.e., containing unhardened pondcrete in at least a portion of the boxes). Severely deformed boxes of waste were transferred to metal boxes or to Building 788 to await reprocessing. Storage of pondcrete resumed in November 1986 and continues to the present.

Two spills of pondcrete have occurred through September 1, 1989. The spills totaled approximately 0.5 cubic ft released to the asphalt pad consisting of unhardened Solar Evaporation Pond sludge and cement. Following each incident, the entire contents of the failed container and spilled Pondcrete were transferred to metal boxes. The spill locations were then cleaned by washing with water using brooms to remove pondcrete from crevices in the asphalts. Water was collected using wet vacuums. Cleaning continued until radiation levels were below detection limits for instruments being used.

Routine inspections of the 750 Pad on November 1, 1988 and April 7, 1989 identified deformed and leaking boxes of Saltcrete. All saltcrete spills have consisted of a fine, dry, powder. From November 1, 1988 through July 25, 1989, a total of 64 leaking boxes were identified that had released approximately 113 pounds of Saltcrete to the Pad. The location of spills were cleaned by vacuuming until radiation levels were below detection limit of the instruments being used.

A site visit of the 750 Pad in May, 1990 observed wet, severely deformed, cardboard boxes being transported into storage tents. Torn boxes with exposed plastic inner liners were observed. There is considered to be a high probability of continued leakage of material until all materials are removed from the Pad.

Portable air monitors were moved to the Pad shortly after the spill incidences. Based on these monitors, there have been no releases that exceed the Plant Screening Guide for plutonium in air of 0.01 pCi/m^3.

3.13.3 Previous Investigations

No soil monitoring has been conducted at the 750 Pad.

Runoff water sampling from the Pad has been carried out. The maximum contaminant levels identified in runoff samples have been 153 $\pm$ 14 pCi/L for gross alpha, 148 $\pm$ 12 pCi/L for gross beta activity, and 87.4 mg/L for nitrate.

The maximum contaminant levels identified in waste samples from the drainage culverts are 164$\pm$ 9 pCi/L for gross alpha, 63$\pm$2 pCi/L for gross beta activity, and 4.5 mg/L for nitrate.

3.13.4 Conceptual Model

3.13.4.1 Contaminant Sources

Chronic spillage of Saltcrete, and to a lesser extent pondcrete has occurred on the 750 Pad. When precipitation events occur, runoff from the 750 Pad would begin flowing into the culvert almost immediately. The time required for water falling at the far western edge of the Pad to flow out of the culvert is calculated to be less than 15 minutes. The 750 Pad berms can be overtopped by as little as 0.03 inches of precipitation runoff. These data indicate that virtually every precipitation event results overtopping.

3.13.4.2 Potential Exposure Pathways

Spills of liquid pondcrete can provide exposure pathways through stormwater runoff, surface water and sediment runoff, and infiltration to groundwater. Infiltration and percolation through the asphalt pad would be contained by the Petromat surface although contamination of the asphalt Pad is possible. Contaminated dust on the Pad can be transported by wind action.

Dry materials from saltcrete spillage can be moved by wind action. Runoff from the Pad can carry contaminated materials into the culverts and streams and lakes in the area. Groundwater can also be affected.

3.13.4.3 Potential Receptors

Potential receptors include humans for all potential exposure pathways identified. Terrestrial biota are potential receptors for inhalation of windborne contaminants and ingestion, dermal contact with surface water. Aquatic biota are also potential receptors of surface water contamination through ingestion and dermal contact.

3.14 PRELIMINARY REMEDIAL ACTION ALTERNATIVES

In order to efficiently conduct an investigation and remediation program for potentially contaminated sites, it is necessary to identify remedial action alternatives on a preliminary basis early in the program. The identification of preliminary alternatives will ensure that the data to be collected in the Phase I RFI/RI will support the Corrective Measures Study/Feasibility Study (CMS/FS). Based on the conceptual models developed for OU 3 Other Outside Closures, the following have been identified as preliminary remedial action alternatives:

- No Action
- Excavation and on-site treatment
- Excavation and off-site treatment/disposal
- *In situ* treatment
- *In situ* containment (i.e., capping, *in situ* stabilization, etc.)
- Containment in an on-site secure landfill
- Free hydrocarbon recovery (applicable for SWMU 129)
- Groundwater removal, treatment, and reinjection.

4.0 WORK PLAN RATIONALE

4.1 DATA REQUIREMENTS

As required by Section VI of the IAG (1989), CERCLA, and RCRA, data are required to define site physical characteristics, define sources of contamination, describe the nature and extent of contamination, and determine the fate and transport of contaminants. This data will also support the evaluation of the need for corrective/remedial action in the BRAP and the development and evaluation of remedial alternatives. Data requirements for this Work Plan are presented below and derived from guidance documents previously cited.

4.1.1 Determine Nature and Extent of Contamination

The intent of soil sampling to be performed during the Phase I RFI/RI is to characterize the nature and determine the horizontal and vertical extent of existing soil contamination. The objective of the proposed investigation is to provide data from which informed decisions can be made regarding the risk presented by the site and the appropriate remedial responses. Therefore, an analytical level is required which yields data quality sufficient for risk assessment, subsequent analysis, and determination of remedial alternatives.

A phased soil sampling program will be conducted for the Phase I RFI/RI. Samples collected during Phase IA will be analyzed to define the spatial or horizontal nature and extent of contamination. Sampling conducted during Phase IB will ascertain the vertical nature and extent of contamination, refining the preliminary contamination assessment developed from Phase IA data.

Available source location data, physical site information, and pre-existing monitoring results should be used preliminarily, to determine appropriate initial soil sampling locations and indicate background conditions, in an effort to provide a more comprehensive assessment and characterization of contamination.

4.1.2 Support Risk Assessment

In order to meet the objectives of the Risk Assessment, specific data need to be obtained to accomplish the four tasks of the Risk Assessment which are contaminant identification, exposure assessment, toxicity assessment, and risk characterization.

All these tasks will rely on data collected under a sampling plan which will be adequate to determine all contaminants present and the concentrations at which they are present. Contamination within different environmental media must be adequate to characterize the contamination distribution in lateral and vertical extent and be representative of sampled areas. Background or control data must also be collected at uncontaminated areas to determine the degree to which contamination may affect receptors.

Specifically, this requires an inventory of contaminants detected and associated concentrations and presentation of the spatial distribution of contaminants in the lateral and vertical extent.

Data pertaining to physical characteristics of topography, soil, aquifers, and weather patterns need to be collected to determine potential migration pathways.

Characteristics and locations of potential human populations and biological populations must be determined. Models used to model dispersion of contaminants and exposure pathways will be determined later. Hence, data parameters required for these models will be presented in a Memorandum once appropriate models are determined.

Recent toxicity information on all identified contaminants need to be collected to evaluate the migration potential of each contaminant and to determine potential risks to the identified receptors.

4.1.3 Support Selection of Remedial Action Alternatives

Data requirements for the evaluation of remedial action alternatives include an identification of the nature of contamination at sites of concern. In addition, the volumes and areas of contaminated media must be determined. This work plan addresses the sampling required to determine the nature and extent of contaminated soil at OU 3 Other Outside Closures. Other supportive studies for alternative selection include treatability studies and geological characterization. These other studies are outside the scope of this Work Plan.

4.2 DATA QUALITY OBJECTIVES (DQOs)

DQOs are based on the concept that different data uses may require different data quality. Data quality is defined as the degree of certainty of a data set with respect to precision, accuracy, reproducibility, comparability, and completeness. DQOs are qualitative and quantitative statements specifying the required quality of data required to support RFI/RI activities including screening, characterization and risk assessment, and to support engineering alternative evaluation and selection decisions.

The five categories of data quality as presented in EPA's <u>Data Quality Objectives for Remedial Response Activities Development Process</u> are as follows:

- <u>Screening</u> (DQO Level 1) provides the lowest data quality but the most rapid results, and is used for purposes of site health and safety monitoring, preliminary comparison to ARARs, and initial site characterization to define areas for further study. The data generated provides presence-absence of certain constituents and is generally qualitative rather than quantitative.

- <u>Field Analysis</u> (DQO Level 2) provides rapid results but better quality data. Analysis includes some mobile-lab generated data and data generated by use of analytical instruments which are carried in the field. The data may be qualitative or quantitative.

- <u>Engineering</u> (DQO Level 3) provides an intermediate level of data quality and may be used for site characterization or risk assessment. Engineering analysis includes mobile lab-generated data and standard commercial laboratory analyses without full CLP documentation. These data are both qualitative and quantitative. If analysis are conducted in support of treatability models it will be performed to Level 3.

- <u>Confirmational</u> (DQO Level 4) provides the highest level of data quality and is used for purposes of risk assessment, engineering design, and cost recovery documentation. Confirmation analyses require full CLP analytical and data validation procedures.

- <u>Nonstandard</u> (DQO Level 5) refers to analysis by nonstandard procedures, for example, exacting detection limits, or analyses of an unusual chemical compound. These analyses often require method development or adoption. The data validation procedures of Level 4 can be applied to Level 5 if required.

The DQO for the OU 3 Other Outside Closures Phase I RFI/RI soil sampling will be Confirmational (DQO Level 4).

4.3 WORK PLAN APPROACH

The Phase I RFI/RI has been designed to characterize the soils and potential sources of contamination at the sites comprising OU 3 Other Outside Closures. The approach of this Work Plan involves iterative soil sampling to characterize the horizontal and vertical extent of contaminants. The specific sampling techniques, locations, and analyses are presented in the Appendix A Field Sampling Plan (FSP). The following is a summary of the sampling approach.

Soil sampling has been planned in iterative phases utilizing hollow stem auger drills and continuous core-barrel samplers. Phase IA primarily involves the evaluation of the horizontal extent of contaminants in soils. The Phase IA borings typically extend to 5 ft below the ground surface, and soil will be sampled from the 0 to 1 ft, and 4 to 5 ft depth interval. The rationale for sampling of the 4 to 5 ft depth is primarily based upon historical practice of placing clean fill on ground areas considered to be contaminated, as noted in the discussion of SWMU 213. The existence of asphalt or concrete pavement at a site necessitates the sampling of the overlying pavement as well. Phase IA boring locations have been planned along the presently defined SWMU perimeter to document the presence or absence of contaminants at the SWMU boundary. Borings are also planned for the interiors of SWMUs to adequately characterize potential contamination for the Baseline Risk Assessment and the CMS/FS.

Some boring locations are based on previous sample locations where contaminants were detected under previous programs that did not produce validated data. The specific Phase IA boring locations for each site are presented in Appendix A.

The Phase IA investigation for SWMU 129 differs from the other sites. SWMU 129 is an underground storage tank suspected of releasing hydrocarbons and solvents into the subsurface. The Phase IA investigation involves a soil gas survey to characterize the horizontal extent of contamination, and deep soil bores (to groundwater) with soil sampling to verify subsurface contamination. Completion of two of the bores into shallow monitoring wells has been recommended for measurement of hydrocarbon accumulations.

In addition, the Phase IA investigation for SWMU 205 differs from other sites, involving visual inspection rather than soil borings due to the concrete containment of the SWMU.

Phase IB investigation consists of deep bores which are completed to a 15 ft depth or groundwater, whichever comes first. Phase IB will investigate the vertical extent of contaminants in soils. Location of Phase IB borings will be based upon the results of Phase IA analysis. For purposes of planning, it is assumed that there will be two Phase IB bores per SWMU. Drilling more than two borings in some SWMUs and less in others is expected to be justified based on the Phase IA results.

Evaluation of groundwater at the OU 3 Other Outside Closures will be addressed in the Phase II Investigation. However, it is recognized that the Phase IB borings may be deep enough to be completed as shallow monitoring wells. Therefore, it is proposed that all of the Phase IB borings will be completed as monitoring wells. Well installation plans may be modified based on conditions encountered during field implementation.

5.0 RFI/RI TASKS

5.1 TASK 1 - PROJECT PLANNING

The project planning task involves all efforts required to initiate the Phase I RFI/RI of OU 3 Other Outside Closures. Activities conducted for this project have included review of topographic maps and historical aerial photographs, a site visit, evaluation of existing data, development of conceptual models, and identification of preliminary remedial action alternatives. Results of these activities are presented in Section 3.0 (Initial Evaluation). Identification of data requirements and DQOs are presented in Section 4.0 (Work Plan Rationale).

Several project planning documents including this Work Plan are currently being prepared which pertain to this Phase I RFI/RI as required by the draft IAG (1989). The Field Sampling Plan (FSP) identifies sampling locations and frequencies for each of OU 3 Other Outside Closure sites and is included as Appendix A of this Work Plan. Other documents required by the draft IAG (1989) are a Sampling and Analysis Plan (SAP) and a Health and Safety Plan (HSP). Included in the SAP are a Quality Assurance Project Plan (QAPP) and Standard Operating Procedures (SOP) for all field activities. The QAPP and SOP are being completed by EG&G and will be submitted in draft form in July 1990 in accordance with the draft IAG (1989) schedule. The HSP is also being completed by EG&G and will be submitted in draft form in June 1990.

5.2 TASK 2 - COMMUNITY RELATIONS

The information contained in this section is summarized from DOE (1990). In accordance with the draft IAG (1989), the Communications Department at Rocky Flats is developing a Plant-wide Community Relations Plan (CRP) to develop an interactive relationship with the public relating to environmental restoration activities. A work plan has been completed and forwarded to EPA, CDH, and the public for review. The work plan specifies activities planned to complete the ER Program CRP, including plans for community interviews. The Community Survey Plan was completed in March 1990, the draft CRP will be completed in September, and final CRP in November 1990 in accordance with the draft IAG (1989) schedules. Accordingly, a site-specific CRP is not required for OU 3 Other Outside Closures. The ER Program community relations activities include participation by Plant representatives in: informational workshops; meetings of the Rocky Flats Environmental Monitoring Council; briefings for the public on proposed remedial action plans; and sponsoring meetings to solicit public comment on various ER Program plans and actions.

The Communications Department is continuing other public information efforts to keep the public informed of environmental restoration activities and other issues related to Plant operations. A Speakers Bureau Program sends speakers to civic groups and educational organizations, while a public tour program allows the public to visit Rocky Flats. An Outreach Program is also in place where Plant officials visit elected officials, the news media, and business and civic organizations to further discuss issues related to Rocky Flats and environmental restoration activities. The Communications Department receives numerous public inquiries which are answered during telephone conversations, or by sending written informational materials to the requestor.

5.3 TASK 3 - FIELD INVESTIGATIONS

Field investigations will be conducted to delineate the vertical and horizontal extent of soil contamination associated with the operation of OU 3 Other Outside Closures SWMUs. The field investigation will also provide data for evaluating the actual or potential risk posed by the site to human health and the environment. The field investigation anticipates a two-step approach to Phase I soil evaluation. Phase IA will focus on defining the areal extent of contamination through soil gas and shallow soil sampling to a depth of 5 ft. Phase IB will in areas of high level contamination involve deep borings to a depth of 15 ft or the water table, whichever is shallower, to evaluate vertical extent of contamination. Additional shallow borings may be included in this phase to better define the lateral extent contamination. Shallow soil borings are typically on the order of 1 ft in depth. Because of the practice of covering contaminated soils with clean soil to reduce wind dispersion in some areas, it is necessary to extend the depth of Phase IA shallow borings to 5 ft to ensure detection of buried soil surfaces.

Because of the diverse nature of the 13 SWMUs in OU 3 Other Outside Closures, they were divided into four categories based on the SWMU surface or unique features of the SWMU. The four categories and corresponding SWMU numbers are:

		SWMU
I)	Soil/Fill Surface	
	PU&D Storage Yard - Waste Spills	174
	S&W Building 980 Container Storage Facility	175
	S&W Contractor Storage Yard	176
	Building 334 Cargo Container Area	181
	Inactive D-836 Hazardous Waste Tank	206
II)	Asphalt/Concrete Surface	
	Building 885 Drum Storage Area	177
	Building 444/453 Drum Storage Area	182
	Inactive Building 444 Acid Dumpsters	207
	Inactive 444/447 Hazardous Waste Storage Area	208
	Unit 15, 904 Pad Pondcrete Storage	213
	Unit 25, 750 Pad Pondcrete and Saltcrete Storage	214
III)	Leaking Underground Storage Tank	
	Building 443 No. 4 Fuel Oil Tank	129
IV)	Fiberglass Acid Sump	
	Building 460 Sump #3 Acid Side	205

Category I SWMUs consist of storage areas where containers were placed directly on soil or fill material. Samples will be taken from 0 to 1 ft and 4 to 5 ft depths. Cores will be screened for the presence of volatile organic and radioactive materials and additional samples will be taken from those zones which screen positive.

Category II SWMUs consist of storage areas where containers were placed on asphalt or concrete surfaces. Small diameter (approximately 1 inch) core plugs will be taken at the site of the soil boring. Plugs will be analyzed for radionuclides and metals. Because of the high levels of naturally occurring metals in concrete, a concrete plug should be collected away from the area of possible contamination to provide a reference sample. A hole sufficient to accommodate the soil sampling auger will be cut in the asphalt/concrete pad. Samples will be taken from 0 to 1 ft below the pad and 4 to 5 ft below the pad. Cores will be screened for the presence of volatile organic and radioactive materials and additional samples will be taken from those zones which screen positive.

The Category III SWMU consists of an underground storage tank which stored fuel oil, diesel oil, and a waste mixture of water and compressor oil. The tank is believed to have leaked material. Soil gas will be conducted at this site to determine the extent of volatile organic contamination. Soil samples will be taken from a continuous core drilled to groundwater, and the boring will be completed as a monitoring well. A water sample will be collected from the monitoring well.

Category IV SWMUs consist of a free-standing fiberglass sump containing acid located in Building 460. If there are no indications of spills or leakage, and if the fiberglass tank acting as the sump shows no signs of leakage at pipe fittings or cracks, no samples will be taken. If any signs of leakage are observed, sampling will follow the procedure outlined for Category II SWMUs.

Sampling locations for all sites are presented in the FSP (Appendix A). The FSP also descrives the equipment and procedures which will be used during the field investigation. At the completion of Phase IB, the previously defined SWMU boundaries will be remapped and the SWMU size increased or decreased dependent on the location of the contamination. The corners of the new SWMU boundaries will be surveyed for future reference points.

5.4 TASK 4 - SAMPLE ANALYSIS/VALIDATION

All analytical procedures will be in accordance with the ER program QA/QC plan (Rockwell International, 1989a). Also provided in this document are the analytical detection limits, sample container and volume requirements, preservation requirements, and sample holding times. Sample analysis will be conducted by an RFP contract laboratory.

Data will be reviewed and validated by the ER Program staff or a designated contractor. Results of data review and validation activities will be documented in data validation reports. EPA data validation functional guidelines will be used for validating organic and inorganic (metals) data (EPA, 1988b). Validation methods for radiochemistry and major ions data have not been published by the EPA; however, data and documentation requirements have been developed by the ER Program Quality Assurance staff. Data validation methods for these data are derived from these requirements. Details of the data validation process are described in the QA/QC Plan (Rockwell International, 1989a) and the Data Validation Guidelines (EG&G, 1990a).

When the guidelines for validating radiochemistry analytical data are published, it should be noted that the validation criteria contained in the guidelines (both EPA-CLP and EG&G Rocky Flats documents) will not strictly parallel CLP or EG&G Rocky Flats Scopes of Work in all cases. These documents were created as "guidelines" rather than "standard operating procedures" to allow data reviewers to exercise appropriate discretion and professional judgment in evaluating data.

5.5 TASK 5 - DATA EVALUATION

Data collected during Phase I will be incorporated with existing data describing soil contamination for OU 3 Other Outside Closures SWMUs. The objectives of the data evaluation effort as described in Section VI.B of the IAG (1989), will include analysis of actual and potential magnitude of releases from sources, and horizontal and vertical spread of contamination as well as mobility and persistence of contaminants.

5.5.1 Validation of Existing Soil Samples

Validation of existing soil samples for SWMUs will be carried out prior to incorporation of data into soil database.

5.5.2 Characterization of the Nature and Extent of Soil Contamination

Standard graphical and, where appropriate, statistical analysis methods will be employed to: 1) identify the major organic, inorganic, and radiogenic contaminants present in soils; 2) determine the concentrations and spatial distribution of contaminants in soil; 3) evaluate contamination associated with the operation of SWMUs. Numerous types of work products, such as soil and sediment chemical tables, soil concentration isopleth maps, soil concentration versus depth profiles, and overlays of soil concentrations and SWMU boundary maps and others as described in EPA's interim final Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA will be used in the characterization of the nature and extent of soil contamination.

5.6 TASK 6 - RISK ASSESSMENT

A baseline risk assessment will be prepared for the OU 3, Other Outside Closures as part of the Phase I RFI/RI to evaluate the potential threat to the public health and the environment in the absence of remedial action. The baseline risk assessment will provide the basis for determining whether or not remedial action is necessary in the area and serve as the justification for performing remedial action (EPA, 1988b). EPA's interim final "Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual" (EPA, 1989a) provides detailed guidance on evaluating potential human health impacts as part of this baseline assessment. The steps of a Baseline Risk Assessment are shown in Figure 5-1. The outline to be followed for the Baseline Risk Assessment Plan is shown in Appendix B.

Several objectives will be accomplished under the risk assessment task including identification and characterization of the following (EPA, 1988b):

- Toxicity and levels of hazardous and radioactive contaminants present in relevant media (e.g., air, ground water, soil, surface water, sediment, and biota)
- Environmental fate and transport mechanisms within specific environmental media and cross-media fate and transport where appropriate
- Potential human and environmental receptors
- Potential exposure routes and extent of actual or expected exposure
- Extent of expected impact or threat; and the likelihood of such impact or threat occurring (i.e., risk characterization)
- Level(s) of uncertainty associated with the above.

The risk assessment will address the potential public health and environmental impacts associated with the site under the no-action alternative (no remedial action taken). This assessment will aid in the selection of site remedies based on the contaminants of concern and the environmental media associated with potential risks to public health and the environment.

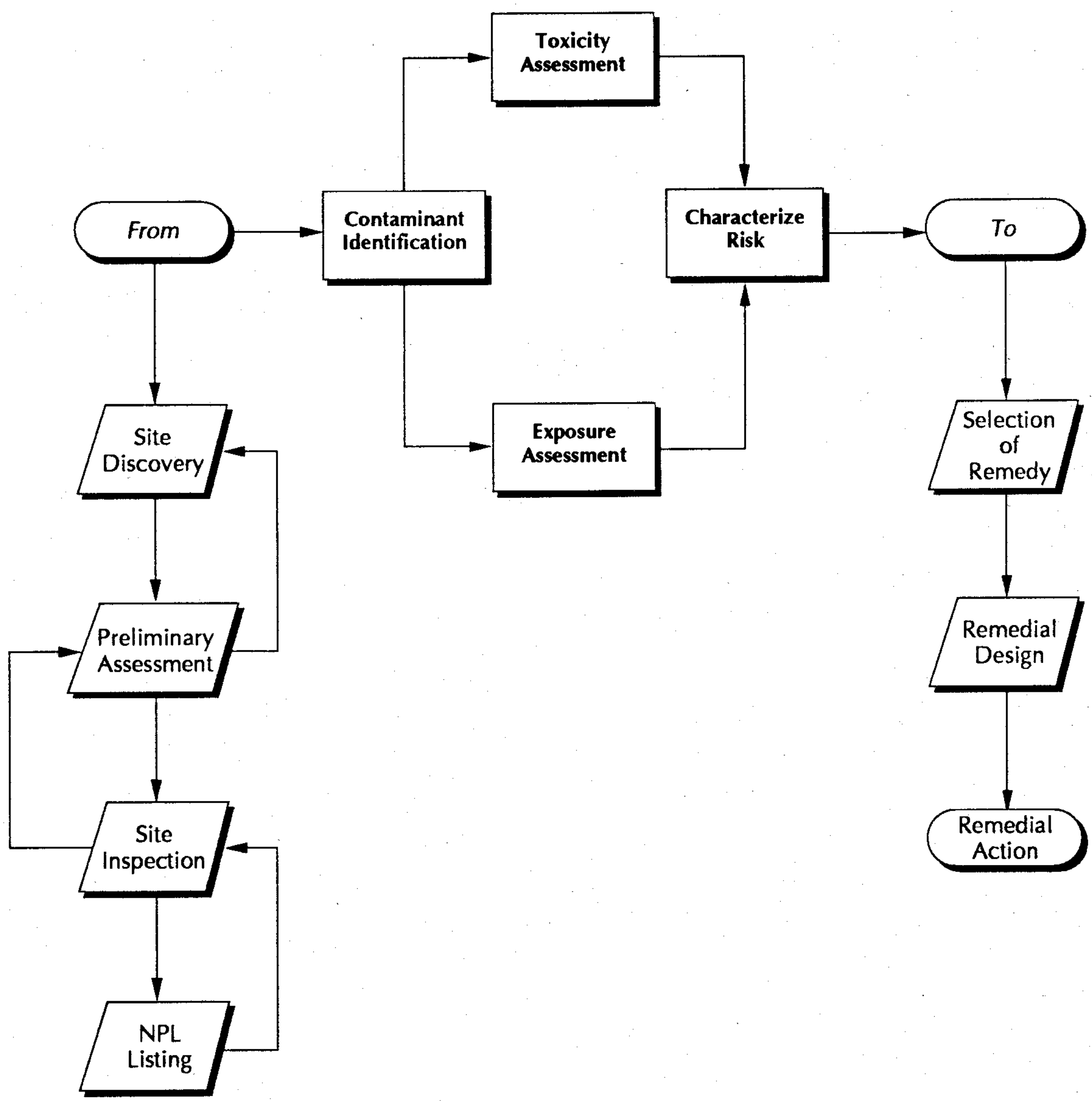

Figure 5-1 • Baseline Risk Assessment Development Process

During the scoping of the Baseline Risk Assessment Plan, the format of the Baseline Risk Assessment Plan as well as the references to be used during the Baseline Risk Assessment will be discussed with the EPA and the State (IAG, 1989).

The risk assessment process is divided into four tasks (EPA, 1988b), including:

- Contaminant identification
- Exposure assessment
- Toxicity assessment
- Risk characterization.

The task objectives and description of work for each task are described in detail in the Baseline Risk Assessment Plan for OU 3 Other Outside Closures attached as Appendix B of this report.

5.7 TASK 7 - TREATABILITY STUDIES

This task includes efforts to select, prepare, and conduct laboratory-, bench-, and pilot-scale treatability studies in accordance with EPA Guidance (EPA, 1989c). These activities will serve to determine the implementability, effectiveness, and cost of a particular remedial technology. A comprehensive plan for treatability studies designed for remediation of waste sources, soils, and water at all operable units at Rocky Flats will be prepared and submitted to the regulatory agencies in July 1990 in accordance with the draft IAG (1989) schedule.

The site-wide treatability studies program is part of a comprehensive, phased program of site characterization, remedial investigations, feasibility studies, and remedial/corrective actions currently in progress to address contamination associated with the Rocky Flats Plant. The overall objective of the treatability studies program is to support the CMS/FSs that will be conducted at each of the 10 OUs. The program will shorten the overall time required to complete these studies by identifying technologies which are potentially applicable for remediating the types of wastes and waste matrices that may be common to more than one OU. Conducting treatability studies on these technologies as part of the treatability studies program will generate the data required to evaluate and screen technologies and/or alternatives. The program will be implemented in parallel with the CMS/FSs, but will not replace the extensive identification and screening of technologies that will be conducted by the CMS/FS at each OU, nor will it completely eliminate the need for treatability studies to be conducted during the individual CMS/FSs.

Treatability studies specific to OU 3 Other Outside Closures will be identified as data become available. Treatability Study needs will be addressed as part of the Phase I Proposed Interim Measure/Interim Remedial Action (IM/IRA) Decision Document. Treatability Studies may also be implemented for the Phase II CMS/FS Report.

5.8 TASK 8 - PHASE I RFI/RI REPORT

5.8.1 Report Content

The Phase I RFI/RI report will summarize the findings of the Phase I soil contamination RFI/RI program for OU 3 Other Outside Closures SWMUs. The report will be organized into sections that will provide an overview of the RFI/RI program, describe the physical features of the site and individual SWMUs, and present the results of the soil contamination investigation. The report will also include sections describing soil contamination related to activities of the SWMUs and baseline risk assessment. A preliminary Table of Contents for the draft final report is presented in Table 5-1.

5.8.2 Report Revisions

The Phase I RFI/RI report will be issued as a draft final report that will undergo two formal revisions. The first revision (revised draft final) will incorporate agency comments from EPA and CDH and the second revision (final) will incorporate comments from the public.

5.9 PHASE I IM/IRA

The investigation and evaluation of OU 3 Other Outside Closures will be conducted in accordance with Section I.B.11.b of the IAG Statement of work. Based on the information collected in the Phase I RFI/RI and the Baseline Risk Assessment, a draft Phase I CMS/FS

Table 5-1. Table of Contents for Phase I RFI/RI Report.

will be prepared. The Phase I CMS/FS will identify alternatives for remediation of contaminated soils identified by the Baseline Risk Assessment, and will provide the information required to recommend an alternative. The draft Phase I CMS/FS will be submitted for review by EPA and the State as part of the draft Phase I IM/IRA Decision Document for OU 3 Other Outside Closures. The Decision Document will recommend and justify priority removal actions at sites that have been identified for interim remediation. If an IM/IRA is recommended for OU 3 Other Outside Closures, then design and implementation of the IM/IRA will follow.

5.10 PHASE II RFI/RI

In order to fully characterize the nature and extent of contamination of OU 3 Other Outside Closures, a Phase II RFI/RI effort will be conducted. The Phase II investigation will address groundwater contamination of these sites. The Phase II investigation will include field activities such as monitor well installation, development, and sampling. Data from the Phase II sampling program will be evaluated and presented along with a comprehensive Baseline Risk Assessment in the Phase II RFI/RI Report. The Phase II RFI/RI Report will re-evaluate the IM/IRA implemented at each site for impacts affecting the selection of a final remedy.

5.11 PHASE II CMS/FS

The Phase II RFI/RI Report will be used to support the Phase II CMS/FS. OU 3 Other Outside Closures will be combined with the Original Process Waste Lines for this evaluation. The Phase II CMS/FS will include sufficient information to recommend a final action for OU 3 Other Outside Closures and the Original Process Waste Lines. The CMS/FS report will include documenting remedial action objectives, developing general response actions to meet the objectives, and identifying areas or volumes of contaminated media. Remedial technologies will be identified and screened for effectiveness, and process options will be evaluated on the basis of effectiveness implementability and cost. A range of alternatives will be assembled from representative process options. Each alternative will be screened based on effectiveness, implementability, and cost, and the retained alternatives will be evaluated in detail prior to selection of the preferred alternative.

5.12 REMEDY SELECTION

Upon approval of the Final Phase II CMS/FS report, a Final Action Plan will be developed to document the planned remedy for contamination at OU 3 Other Outside Closures and the Original Process Waste Lines. The selected remedy will be documented by the Corrective Action Decision/Record of Decision (CAD/ROD), approved by the State and EPA. The draft CAD/ROD when approved will initiate implementation of the final action.

5.13 FINAL ACTION IMPLEMENTATION

Engineering plans and specifications for the final action will be prepared following approval of the CAD/ROD. Final action construction and implementation is currently scheduled for mid-1999 to mid-2000.

6.0 PROJECT MANAGEMENT

6.1 PROJECT ORGANIZATION AND APPROACH

The proposed organizational structure for the Phase I RFI/RI investigation is presented in Figure 6-1. The sampling will be conducted by a corporate organization contracted with EG&G at Rocky Flats. The Project Manager of the contractor is responsible for monitoring the progress of work to ensure that adequate resources are available and that major problems are prevented or minimized. The Project Manager ensures that the RFI/RI Manager meets the program standard for quality at Rocky Flats. The Project Manager's review concentrates on the technical quality, schedule, and cost of work performed.

The RFI/RI Manager has primary responsibility and authority for implementing and executing the RFI/RI effort. Supporting the RFI/RI Manager are the Field Operations Leader (FOL), the Field Quality Assurance Coordinator (FQAC), and the Site Health and Safety Officer (HSO). The Site HSO is responsible for ensuring that all field activities abide by the Health and Safety Plan (HSP). The FQAC is responsible for ensuring adherence to the QAPP, and reviewing all field documentation for accuracy and completeness prior to entry of field data into the Rocky Flats Database. The FOL is responsible for on-site management during the duration of all on-site activities related to this effort. The FOL will coordinate field sampling activities on-site. The FOL will be the primary contact for on-site subcontractors such as surveyors, the Sample Team Leader and the Sample Coordinator. The Sample Team Leader and members of the Sample Team will conduct the sampling and document field observations at each SWMU. The Sample Coordinator will receive the samples and supporting documentation from the Sample Team, ensure that proper documentation is in order, package the samples and arrange for shipment to the analytical laboratory.

Coordination of the Phase I RFI/RI investigation with the Rocky Flats facility will be maintained by an oversight contact from the Environmental Restoration Program Office of EG&G. Coordination with the CDH, the lead regulatory agency for the sites to be investigated, will be implemented by EG&G.

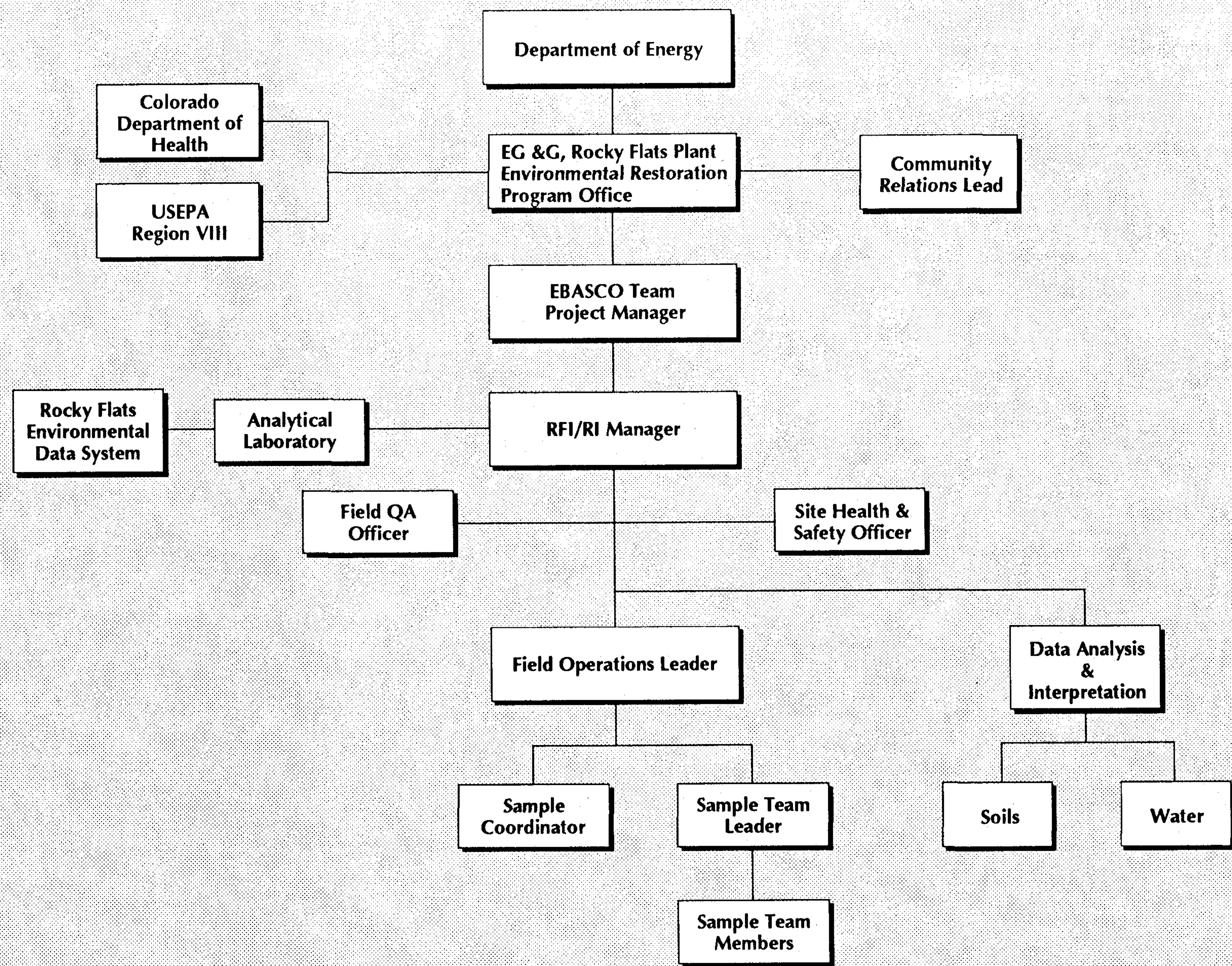

Figure 6-1 • Proposed Organizational Structure

6.2 QUALITY ASSURANCE AND DATA MANAGEMENT

Implementation of the RFI/RI investigation will be in accordance with the QAPP for OU 3 at the Rocky Flats site that is currently under development by EG&G. Field data will be reviewed by the FQAC Officer of the contractor prior to entry into the database. Analytical data from the laboratory will be delivered in coded format for entry into the database. Data validation will be performed under separate contract in accordance with the Rocky Flats data validation program.

6.3 PROJECT SCHEDULE AND DELIVERABLES

The contractor will propose a schedule to accomplish the work. Project deliverables will include the following documents:

- Draft Phase I RFI/RI Report, submitted for review to the Environmental Restoration Program Office and DOE.
- Draft Final Phase I RFI/RI Report, incorporating review comments, submitted for review to DOE, CDH, and EPA Region VIII.
- Written responses to regulatory agency comments.
- Final Phase I RFI/RI Report.

7.0 REFERENCES

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APPENDIX A

FIELD SAMPLING PLAN

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1.0 SAMPLING OBJECTIVES

This Field Sampling Plan (FSP) sets out the procedures and sample locations for the field activities involved in collecting soil samples for OU 3 Phase I RFI/RI. The FSP has been prepared in accordance with Environmental Protection Agency (EPA) guidance (USEPA, 1988). The objectives of the soil sampling program are:

- Determine the nature, level, vertical, and horizontal extent of soil contamination associated with OU 3 Other Outside Closure SWMUs.

- Evaluate the potential for soil contamination associated with the activities of designated Solid Waste Management Units (SWMUs) within OU 3.

2.0 SAMPLING LOCATION AND FREQUENCY

A summary of the proposed borings and monitor wells for the Phase I RFI/RI of OU 3 Other Outside Closures is presented in Table 2-1. Sample collection will be an iterative process consisting of a Phase IA effort concentrating on the horizontal extent of contamination, and a Phase IB effort concentrating on the vertical extent of contamination. The State Planar coordinates for all borings will be determined by survey to ensure proper location of data points on facility maps.

Boring density rationale is based upon a regular distribution of sample data within each SWMU and along the presently defined SWMU boundaries. Borings along the boundary of a given SWMU will be separated by uniform distances to evaluate the potential for contaminant migration beyond the SWMU boundary. Borings will also be placed within each SWMU to characterize potential contamination associated with each SWMU. Boring distribution is designed to detect specific sources associated with each SWMU, such as a cargo container, drum storage area, etc. Two of the SWMUs to be investigated (750 Pad and 904 Pad) cover extensive areas; perimeter boring spacing and boring density in these cases is based upon uniform distribution of data points for adequate evaluation. Borings are also planned at select locations for confirmation of contaminants detected during previous investigations.

Phase 1A sampling locations are specifically outlined in the following sections. Sample intervals for Phase 1A have generally been selected at depths of 0 to 1 ft and 4 to 5 ft, to evaluate contamination at the ground surface and at a reasonable depth. The 4 to 5 ft samples are required to properly evaluate lateral extent of contaminants, in light of historical reports of placing clean fill over areas that were considered contaminated. In addition, the 4 to 5 ft samples will evaluate soil at a depth where infiltrated volatiles would not have completely evaporated, which may occur in the 0 to 1 ft samples. The combination of both sample depths will also document the existence of contamination that is restricted to the near surface, if such is the case.

Table 2-1. Summary of Proposed Phase I Sampling

SWMU #	BOREHOLE	NO. OF SAMPLES*	LOCATION	OBJECTIVE	ASSOCIATED MONITOR WELL
129	Soil Gas Points	30	Along 3 N-S lines above tank and piping.	Determine horizontal extent of leakage.	
	OOC01	3(4)	5 ft North of tank.	Determine horizontal and vertical extent of contaminated soil near tank.	WOOC01 (OOC02)
	OOC02	3(4)	5 ft South of tank.		
	OOC03	3(4)	10 ft West of tank.		
	OOC04	3(4)	10 ft East of tank.		WOOC02 (OOC04)
174	OOC05	2(3)	Perimeter of drum storage area.	Determine extent of potential contamination at SWMU boundary.	
	OOC06	2(3)	Perimeter.		
	OOC07	2(3)	Perimeter.		
	OOC08	2(3)	Perimeter.		
	OOC09	2(3)	Center of drum storage area.	Characterize potential contaminants.	
	OOC10	2(3)	Previous Sample (CS009).	Confirm previous results.	
	OOC11	2(3)	Previous Sample (CS005).		
	OOC12	2(3)	Previous Sample (CS004).		
	OOC13	2(3)	Perimeter of stained soil.	Determine extent of potential contamination at edge of stained soil.	
	OOC14	2(3)	Perimeter of stained soil.		
	OOC15	2(3)	Perimeter of stained soil.		
	OOC16	2(3)	Perimeter of stained soil.		
	OOC17	2(3)	Center of stained soil.	Characterize potential contamination.	
	OOC18	2(3)	Center of stained soil.		
	OOC19	2(3)	Outside of Closure Plan location.	Sample the Closure Plan location.	
	OOC20	2(3)	Outside of Closure Plan location.		
	OOC21	2(3)	Center of Closure Plan location.	Characterize Closure Plan location.	
175	OOC22	2(3)	Perimeter of SWMU.	Determine extent of potential contamination at SWMU boundary.	
	OOC23	2(3)	Perimeter of SWMU.		
	OOC24	2(3)	Perimeter of SWMU.		
	OOC25	2(3)	Perimeter of SWMU.		
	OOC26	2(3)	Perimeter of SWMU.		
	OOC27	2(3)	Perimeter of SWMU.		
	OOC28	2(3)	Perimeter of SWMU.		
	OOC29	2(3)	Perimeter of SWMU.		
	OOC30	2(3)	Perimeter of SWMU.		
	OOC31	2(3)	Perimeter of SWMU.		
	OOC32	2(3)	Interior of SWMU.	Characterize potential contamination.	

* Optional number of samples shown in parantheses; an optional intermediate-depth sample will be collected if contamination is suggested by real-time instrumentation.

Table 2-1. Summary of Proposed Phase I Sampling

SWMU #	BOREHOLE	NO. OF SAMPLES*	LOCATION	OBJECTIVE	ASSOCIATED MONITOR WELL
175 (cont.)	OOC33	2(3)	Interior of SWMU.	Characterize potential contamination.	
	OOC34	2(3)	Interior of SWMU.		
	OOC35	2(3)	Interior of SWMU.		
	OOC36	2(3)	Interior of SWMU.		
176	OOC37	2(3)	Perimeter of SWMU.	Determine extent of potential contamination at SWMU boundary.	
	OOC38	2(3)	Perimeter of SWMU.		
	OOC39	2(3)	Perimeter of SWMU.		
	OOC40	2(3)	Perimeter of SWMU.		
	OOC41	2(3)	Perimeter of SWMU.		
	OOC42	2(3)	Perimeter of SWMU.		
	OOC43	2(3)	Perimeter of SWMU.		
	OOC44	2(3)	Perimeter of SWMU.		
	OOC45	2(3)	Perimeter of SWMU.		
	OOC46	2(3)	Interior of SWMU.	Characterize potential contamination.	
	OOC47	2(3)	Interior of SWMU.		
	OOC48	2(3)	Interior of SWMU.		
	OOC49	2(3)	Previous Sample (CS027).	Confirm previous results.	
	OOC50	2(3)	Previous Sample (CS029).		
	OOC51	2(3)	Previous Sample (CS030).		
	OOC52	2(3)	Previous Sample (CS032).		
	OOC53	2(3)	Previous Sample (CS033).		
177	OOC54	3(4)	Perimeter of SWMU.	Determine extent of potential contamination at SWMU boundary.	
	OOC55	3(4)	Perimeter of SWMU.		
	OOC56	3(4)	Ponding area.	Characterize potential contamination at surface water ponding area.	
	OOC57	3(4)	Ponding area.		
	OOC58	3(4)	Previous sample (CS035).	Confirm previous results.	
	OOC59	3(4)	Previous sample (CS037).		
181	OOC60	3(4)	Perimeter of SWMU.	Determine extent of potential contamination at SWMU boundary.	
	OOC61	3(4)	Perimeter of SWMU.		
	OOC62	3(4)	Perimeter of SWMU.		
	OOC63	3(4)	Perimeter of SWMU.		
	OOC64	3(4)	Interior of SWMU.	Characterize potential contamination.	
	OOC65	3(4)	Interior of SWMU.		
	OOC66	2(3)	Drainage.	Investigate surface water dispersion.	

* Optional number of samples shown in parantheses; an optional intermediate-depth sample will be collected if contamination is suggested by real-time instrumentation.

Table 2-1. Summary of Proposed Phase I Sampling

SWMU #	BOREHOLE	NO. OF SAMPLES*	LOCATION	OBJECTIVE	ASSOCIATED MONITOR WELL
182	OOC67	3(4)	Perimeter of SWMU.	Determine extent of potential contamination at SWMU boundary.	
	OOC68	3(4)	Perimeter of SWMU.		
	OOC69	3(4)	Interior of SWMU.	Characterize potential contamination.	
	OOC70	3(4)	Interior of SWMU.		
	OOC71	3(4)	Previous sample (CS022).	Confirm previous results.	
205	No borings planned for Phase 1A				
206	OOC72	2(3)	Interior of SWMU.	Characterize potential contamination.	
	OOC73	2(3)	Interior of SWMU.		
207	OOC74	3(4)	Perimeter of SWMU.	Determine extent at SWMU bndry.	
	OOC75	3(4)	Center of SWMU.	Characterize potential contamination.	
208	OOC76	3(4)	Perimeter of SWMU.	Determine extent of potential contamination at SWMU boundary.	
	OOC77	3(4)	Perimeter of SWMU.		
	OOC78	3(4)	Perimeter of SWMU.		
	OOC79	3(4)	Perimeter of SWMU.		
	OOC80	3(4)	Interior of SWMU.	Characterize potential contamination.	
	OOC81	2(3)	Drainage.	Investigate surface water dispersion.	
213	OOC82	3(4)	Perimeter of SWMU.	Determine extent of potential contamination at SWMU boundary.	
	OOC83	3(4)	Perimeter of SWMU.		
	OOC84	3(4)	Perimeter of SWMU.		
	OOC85	3(4)	Perimeter of SWMU.		
	OOC86	3(4)	Perimeter of SWMU.		
	OOC87	3(4)	Perimeter of SWMU.		
	OOC88	3(4)	Perimeter of SWMU.		
	OOC89	3(4)	Perimeter of SWMU.		
	OOC90	3(4)	Perimeter of SWMU.		
	OOC91	3(4)	Interior of SWMU.	Characterize potential contamination.	
	OOC92	3(4)	Interior of SWMU.		
	OOC93	3(4)	Interior of SWMU.		
	OOC94	3(4)	Interior of SWMU.		
	OOC95	3(4)	Interior of SWMU.		
	OOC96	2(3)	Drainage.	Investigate surface water dispersion.	
	OOC97	2(3)	Drainage.		
	OOC98	3(4)	Drainage.		

* Optional number of samples shown in parantheses; an optional intermediate-depth sample will be collected if contamination is suggested by real-time instrumentation.

Table 2-1. Summary of Proposed Phase I Sampling

SWMU #	BOREHOLE	NO. OF SAMPLES*	LOCATION	OBJECTIVE	ASSOCIATED MONITOR WELL
213 (cont.)	OOC99	2(3)	West of Pad.	Investigate reports of stockpiled contaminated soil during construction of pad.	
	OOC100	2(3)	West of Pad.		
	OOC101	2(3)	West of Pad.	Determine extent of potential contamination at SWMU boundary.	
214	OOC102	3(4)	Perimeter of SWMU.		
	OOC103	3(4)	Perimeter of SWMU.		
	OOC104	3(4)	Perimeter of SWMU.		
	OOC105	3(4)	Perimeter of SWMU.		
	OOC106	3(4)	Perimeter of SWMU.		
	OOC107	3(4)	Perimeter of SWMU.		
	OOC108	3(4)	Perimeter of SWMU.		
	OOC109	3(4)	Perimeter of SWMU.		
	OOC110	3(4)	Perimeter of SWMU.		
	OOC111	3(4)	Perimeter of SWMU.		
	OOC112	3(4)	Perimeter of SWMU.		
	OOC113	3(4)	Interior of SWMU.	Characterize potential contamination.	
	OOC114	3(4)	Interior of SWMU.		
	OOC115	3(4)	Interior of SWMU.		
	OOC116	3(4)	Interior of SWMU.		
	OOC117	3(4)	Interior of SWMU.		
	OOC118	3(4)	Drainage.	Investigate surface water dispersion.	
	OOC119	2(3)	Drainage.		
	OOC120	2(3)	Drainage sediment.		
	OOC121	1	Drainage.		
	OOC122	2(3)	To be determined based on Phase IA results.	Characterize vertical extent of contamination.	WOOC03-WOOC28
All SWMUs Phase IB	26 Borings	104 soil 26 grdwtr.			28 wells
TOTAL	148 Borings	302(422) soil samples 26 groundwater samples.			

* Optional number of samples shown in parantheses; an optional intermediate-depth sample will be collected if contamination is suggested by real-time instrumentation.

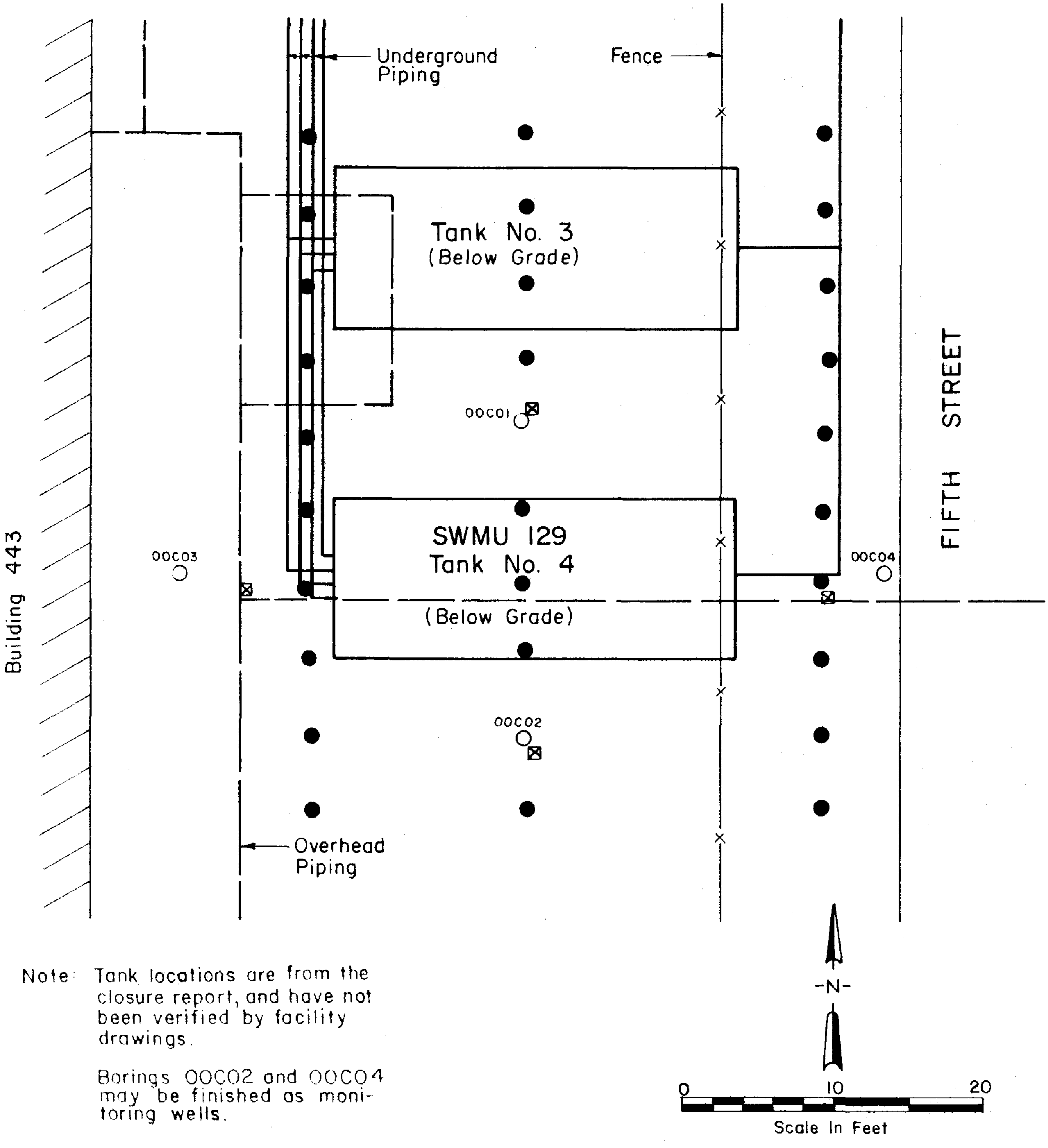
Phase IB boring locations will be determined based on the Phase IA results. For planning purposes, it is assumed that there will be two Phase IB bores for each SWMU, with samples collected at 0 to 1 ft, 4 to 5 ft, 9 to 10 ft, and 14 to 15 ft. The placement of fewer Phase IB bores in some SWMUs and more in others may be justified based on the Phase IA results. All Phase IB bores are candidates for completion into shallow monitoring wells to provide a preliminary assessment of groundwater impacts at these sites. Monitoring wells will be developed and sampled following completion of the wells.

2.1 BUILDING 443 NO. 4 FUEL OIL TANK (SWMU 129)

Soil gas techniques will be used to determine the horizontal extent of potential contamination from leaking pipes or tank. Soil gas is preferred to extensive soil sampling due to its ability to quickly delineate shallow occurrences of volatile hydrocarbons or solvents. Three lines of soil gas data collection points located above the subsurface piping and the tank (see Figure 2-1) will be sampled. Soil gas points extend north past tank No. 3. Soil gas will be analyzed for benzene, toluene, xylenes, trichloroethene, 1,1,1-trichloroethane, methylene chloride, and total volatile hydrocarbons.

Four soil borings are planned to verify soil gas results, and document the presence or absence of soil contaminants in the vicinity of the tank. Soil samples will be collected at depths of 4 to 5 ft (roughly corresponding to the top of the tank), 9 to 10 ft, and at the 1 ft interval immediately above the water table. The deepest sample is intended to document the presence or absence of a hydrocarbon accumulation at the water table.

Two of the borings will be drilled to 5 ft below the water table and completed as shallow monitoring wells. Screen placement will be from 5 ft above to 5 ft below the water table. These wells will be properly developed following completion, and will be used during the Phase II investigation to measure hydrocarbon accumulation and for hydrocarbon recovery tests. It is anticipated that Borings OOC02 and OOC04 will be the best locations for monitoring wells based on high concentrations of hydrocarbons measured during previous investigations. Field observation may be used to change the monitor well locations if it is determined that another boring location would be more suitable for hydrocarbon recovery.



Note: Tank locations are from the closure report, and have not been verified by facility drawings.

Borings 00C02 and 00C04 may be finished as monitoring wells.

Legend

● Proposed Soil Gas Sample Location

00C11 ○ Proposed Boring Location

⊠ Previous Soil Sample Location

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FIGURE 2-1

Proposed Phase IA Sampling Locations for Building 443 No. 4 Fuel Oil Tank (SWMU 129)

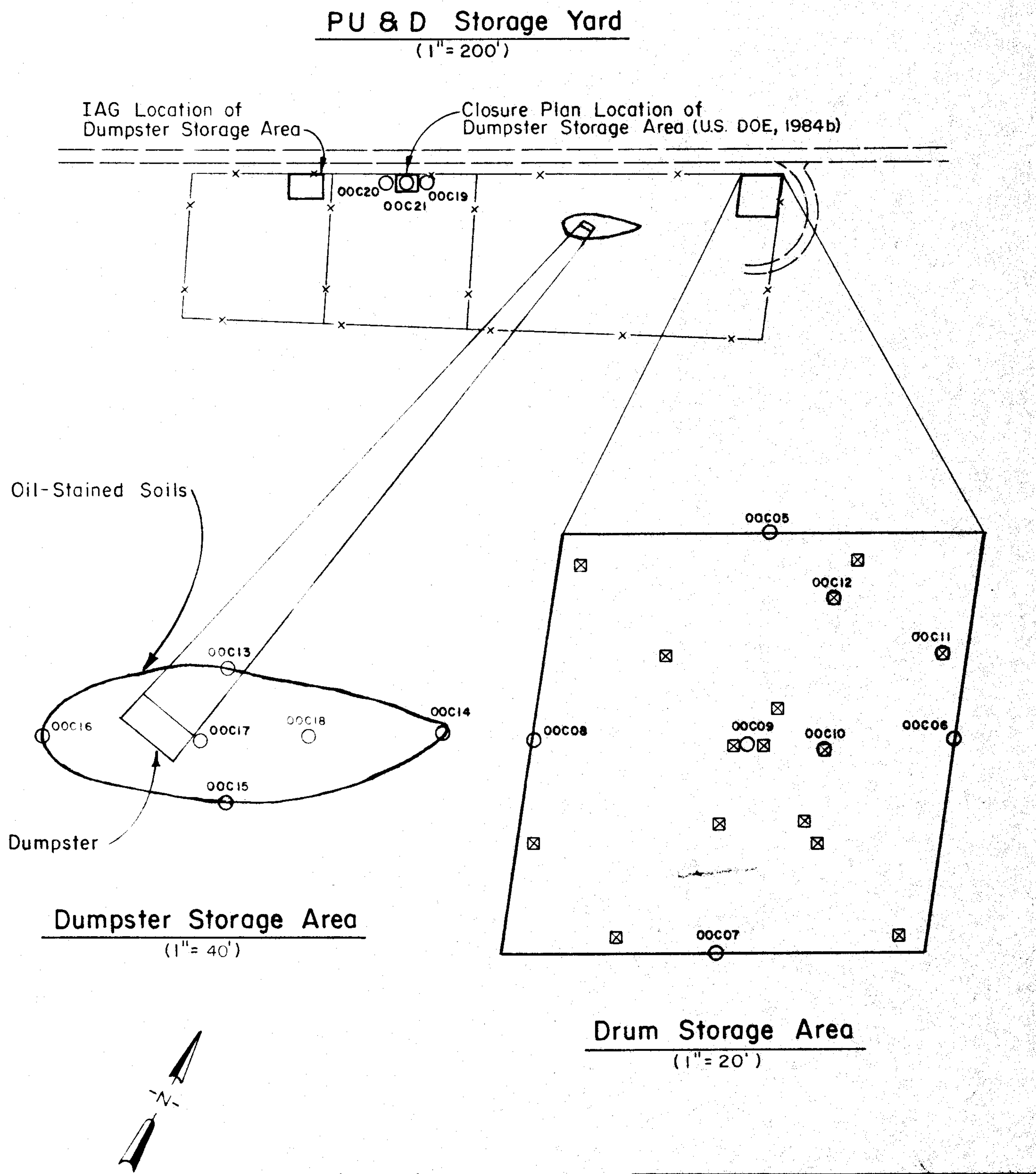
2.2 PU&D STORAGE YARD - WASTE SPILLS (SWMU 174)

Eight borings are proposed for the Drum Storage Area of SWMU 174 during Phase IA (see Figure 2-2). Four borings are located at the reported perimeter of the Drum Storage Area to document the presence or absence of contamination at the SWMU boundary. One boring is located in the center of the area. Three borings are located at previous sample sites stained soil to confirm reported elevated concentrations of 1,1,1-trichloroethane, tetrachloroethene, 4-chloro-3-methylphenol, chrysene, and vanadium. Samples will be collected at depths of 0 to 1 ft and 4 to 5 ft in each boring, with an option for an intermediate-depth sample if contamination is suggested by real-time monitoring during sampling.

Six borings are proposed for the Dumpster Storage Area of SWMU 174 during Phase IA. The location and areal extent of stained soil at the current steel chips dumpster will be confirmed by visual inspection at the site. Four of the borings will be located immediately outside the perimeter of soil staining to document the horizontal extent of contamination. Two borings will be placed within the stained area to characterize the nature of the stained soil. Samples will be collected at depths of 0 to 1 ft and 4 to 5 ft, with an option for intermediate samples if contamination is suggested by real-time monitoring during sampling.

2.3 S&W BUILDING 980 CONTAINER STORAGE FACILITY (SWMU 175)

The location of SWMU 175 has been narrowed to the eastern portion of the Storage Yard located south of Building 980. This site is currently covered with contractor materials that will need to be removed prior to sampling. It is apparent that the storage yard has been graded with fresh gravel since previous investigations in 1988. Attempts will be made to identify the former ground surface that has been covered with fresh gravel during field drilling.



Legend

00C11 Proposed Boring Location

Previous Soil Sample Location

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FIGURE 2-2

Proposed Phase IA Sampling Locations for PU & D Storage Yard-Waste Spills (SWMU 174)

Fifteen borings are proposed during Phase IA due to the unspecific location of this site (see Figure 2-3). Ten borings are located along the perimeter of the SWMU to document the presence or absence of contamination at the SWMU boundary. Five borings are located within the SWMU to characterize potential contamination of the SWMU interior. Samples will be collected at depths of 0 to 1 ft and 4 to 5 ft below the former ground surface, with an option for intermediate-depth samples if contamination is suggested by real-time monitoring during sampling. If a former ground surface cannot be identified during field sampling, then samples will be collected at depths of 0 to 1 ft and 4 to 5 ft below the present ground surface.

2.4 S&W CONTRACTOR YARD (SWMU 176)

Seventeen borings are proposed for SWMU 176 during Phase IA (see Figure 2-4). Nine borings are located along the perimeter of the maximum areal extent of the Contractor Yard at a spacing of approximately 200 ft between borings. The perimeter borings will document the presence or absence of contamination at the Contractor Yard boundary. Three borings are located in the interior of the Contractor Yard to characterize potential contamination. Five borings are located at previous sample sites to confirm reported anomalous concentrations of americium-241, plutonium -239 or -240, and polyaromatic hydrocarbons in the soil. Samples will be collected at depths of 0 to 1 ft and 4 to 5 ft, with an option for intermediate-depth samples if contamination is suggested by real-time monitoring during sampling.

2.5 BUILDING 885 DRUM STORAGE AREA (SWMU 177)

Six borings are proposed for SWMU 177 during Phase IA (see Figure 2-5). Two borings are located along the perimeter of Building 885, offset approximately 1 ft from the building. Two borings are located in surface water ponding areas to the west and southeast of Building 885. Two borings are located at previous sample sites to confirm the reported presence of polyaromatic hydrocarbons in soil. Samples will be collected from the overlying asphalt pavement, and at soil depths of 0 to 1 ft and 4 to 5 ft. An optional intermediate-depth soil sample will be collected if contamination is suggested by real-time monitoring during sampling. Asphalt pavement samples will be analyzed for Hazardous Substance List (HSL) metals and radionuclides. Borings will be grouted to the top of the pavement following sampling.

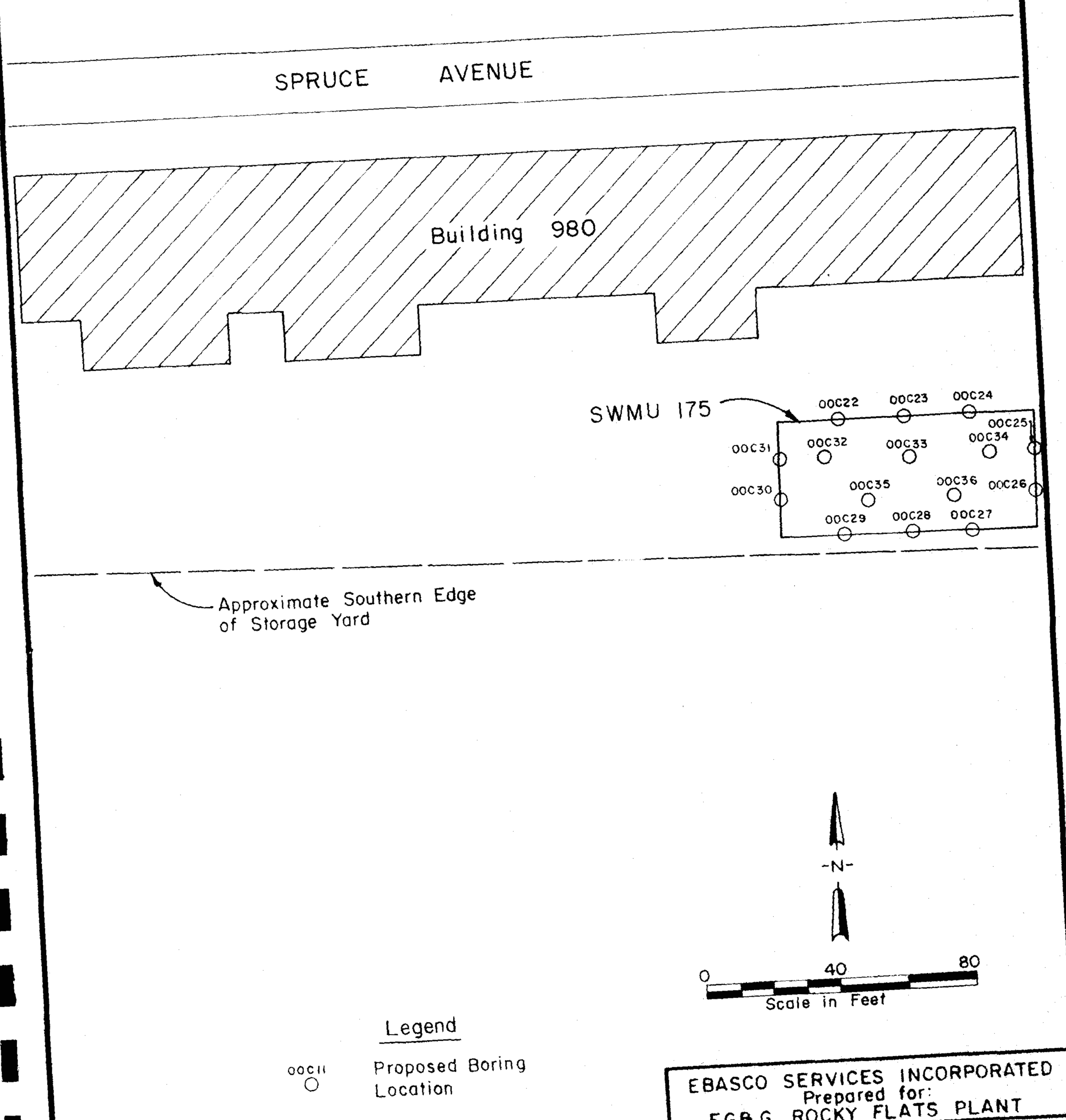

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FIGURE 2-3

Proposed Phase IA Sampling Locations for S&W Building 980 Container Storage Facility (SWMU 175)

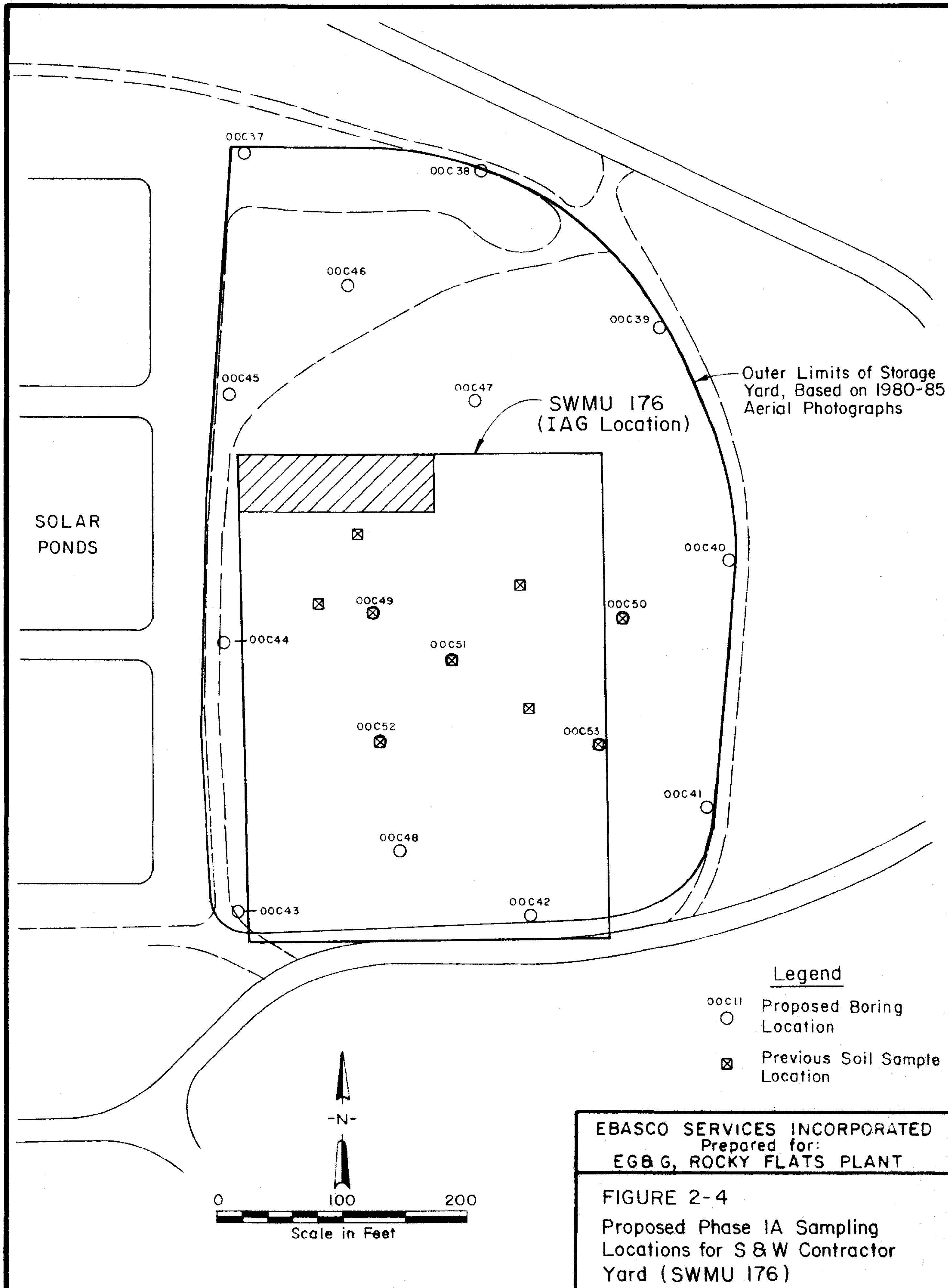

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FIGURE 2-4

Proposed Phase IA Sampling Locations for S & W Contractor Yard (SWMU 176)

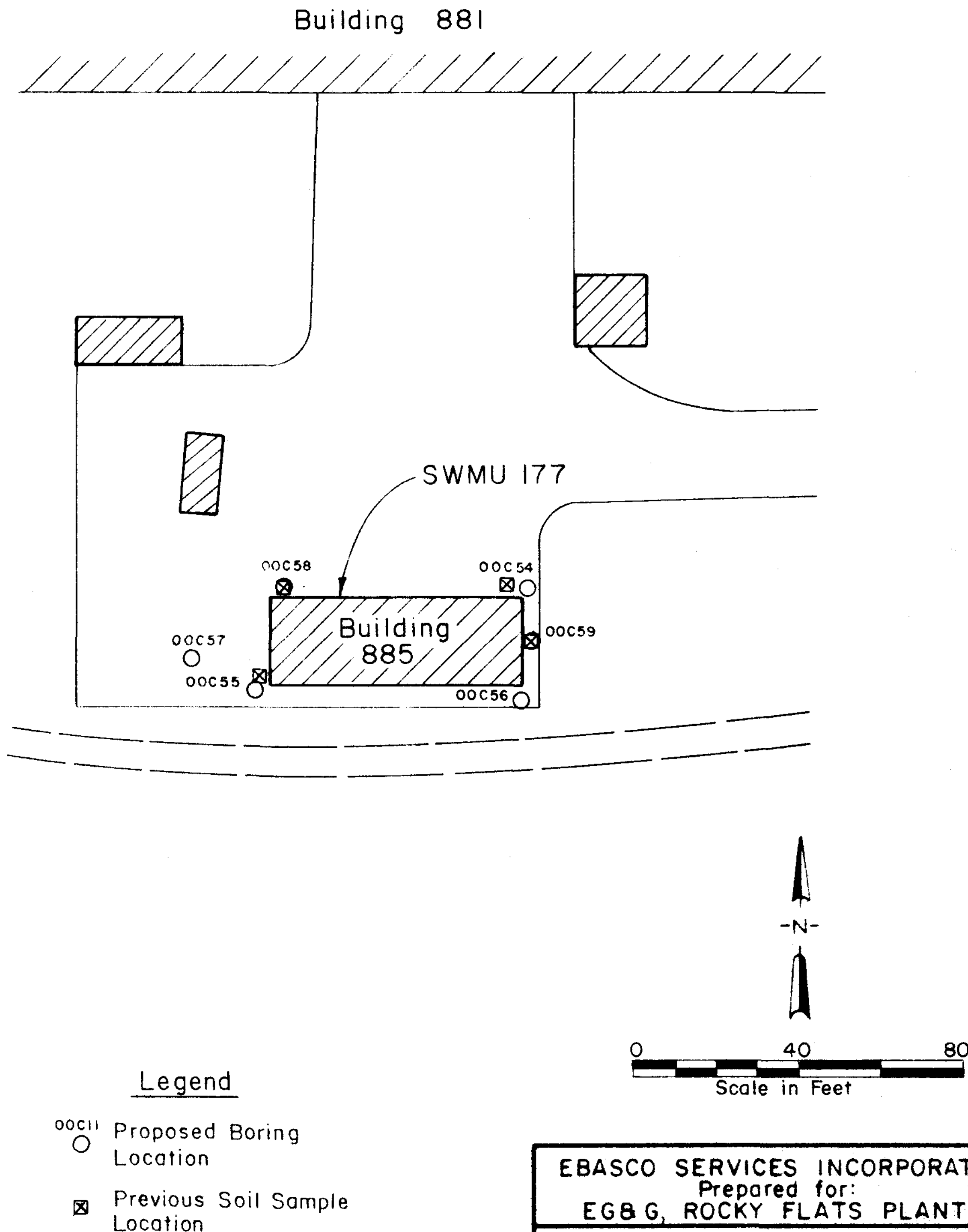

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FIGURE 2-5
Proposed Phase IA Sampling Locations for Building 885 Drum Storage Area (SWMU 177)

2.6 BUILDING 334 CARGO CONTAINER AREA (SWMU 181)

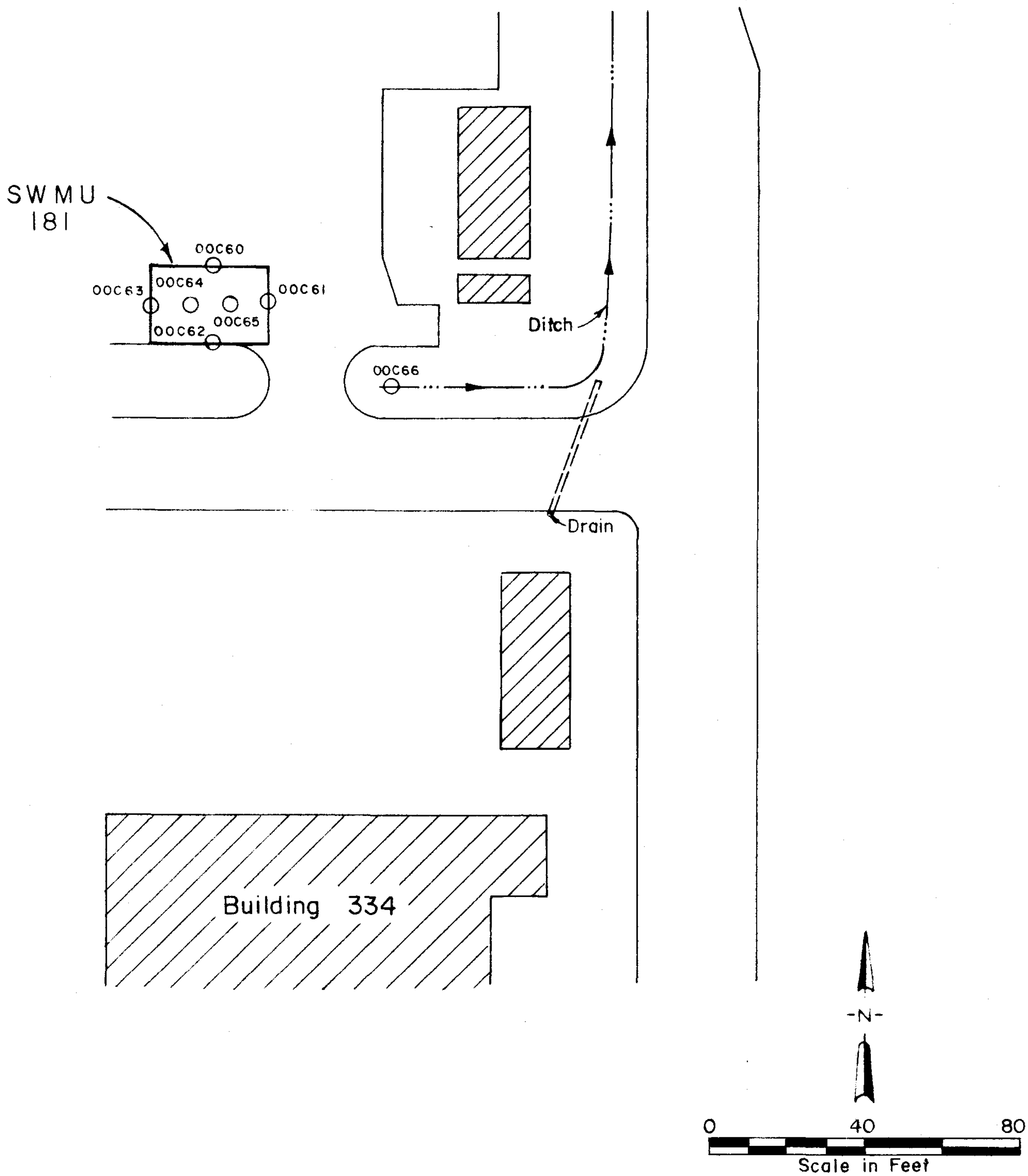
Seven borings are proposed for SWMU 181 during Phase IA (see Figure 2-6). Four borings are located along the perimeter of the SWMU area to document the presence or absence of contamination at the SWMU boundary. Two borings are located in the interior of the SWMU area to characterize potential contamination. Samples will be collected from the overlying asphalt pavement and at soil depths of 0 to 1 ft and 4 to 5 ft. An optional intermediate-depth soil sample will be collected if contamination is suggested by real-time monitoring during sampling. Asphalt pavement samples will be analyzed for HSL metals and radionuclides. The seventh boring is located along a surface water ditch that drains the area. Samples will be collected at depths of 0 to 1 ft and 4 to 5 ft in this boring.

2.7 BUILDING 444/453 DRUM STORAGE AREA (SWMU 182)

Five borings are proposed for SWMU 182 during Phase IA (see Figure 2-7). Two borings are located at the western and southern boundary of the SWMU to document the presence or absence of contamination at the boundaries. Two borings are located in stained interior areas and one borings is located at the site of a previous sample. These borings will characterize potential contamination of SWMU 182 and confirm previous reported detections of high concentrations of polyaromatic hydrocarbons and anomalous concentrations of uranium-238. Samples will be collected from the overlying asphalt pavement where present, and at soil depths of 0 to 1 ft and 4 to 5 ft. An optional intermediate-depth soil sample will be collected if contamination is suggested by real-time monitoring during sampling.

2.8 BUILDING 460 SUMP 3 ACID SIDE (SWMU 205)

Visual inspection of this sump will be conducted as part of the Phase IA investigation. No borings are proposed at this location for Phase IA. If visual inspection reveals indication of sump leakage, such as deteriorated or stained concrete in the sump vicinity, then one boring will be drilled at the sump location as part of Phase IB. If drilled, samples will be collected from the concrete and from soil depths of 0 to 1 ft and 4 to 5 ft.



Legend

00C11 ○ Proposed Boring Location

—►—···— Surface Drainage, Indicating Direction of Flow

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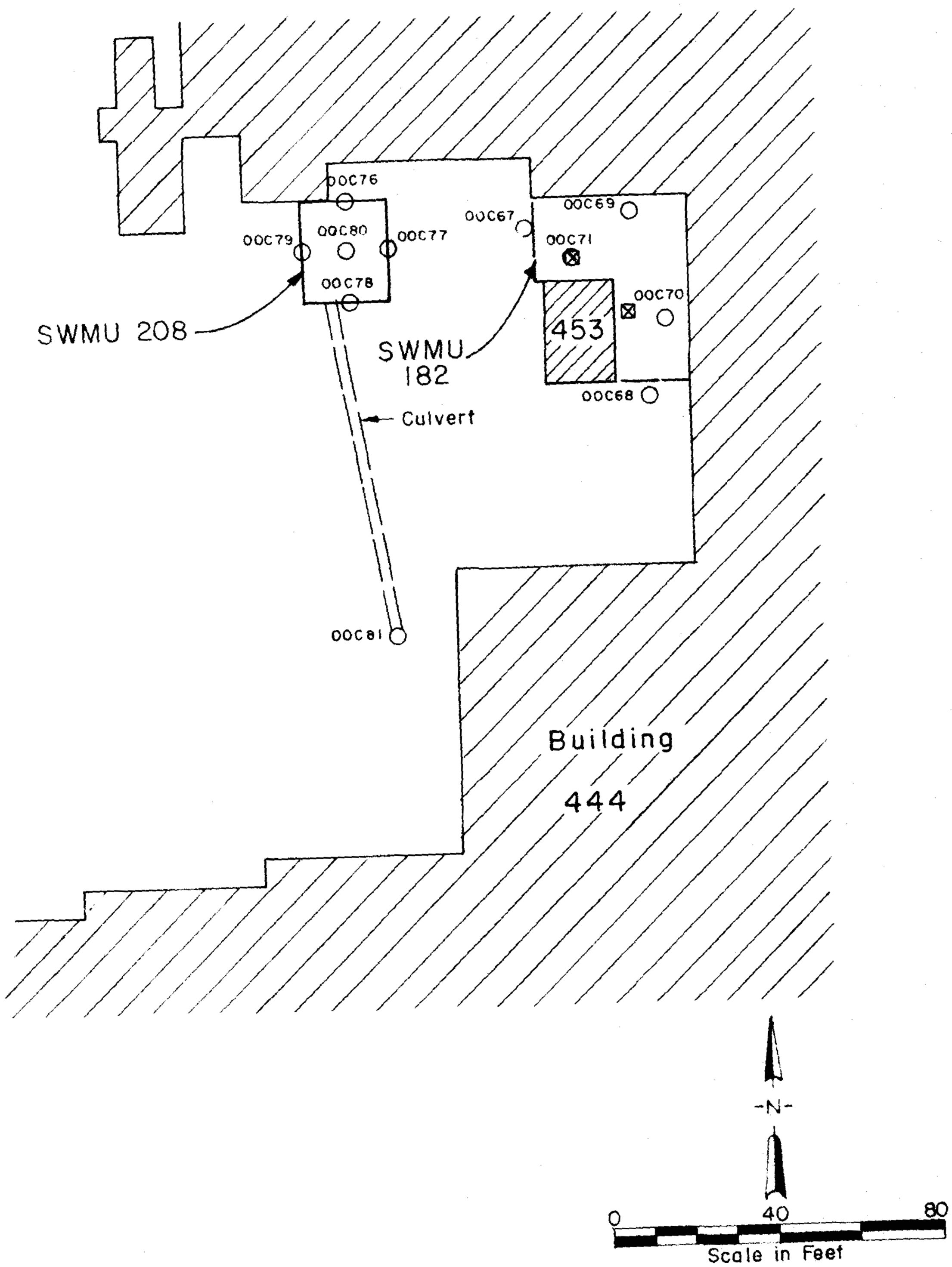
FIGURE 2-6

Proposed Phase IA Sampling Locations for Building 334 Cargo Container Area (SWMU 181)



Legend

00C11 ○ Proposed Boring Location

⊠ Previous Soil Sample Location

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FIGURE 2-7

Proposed Phase IA Sampling Locations for Building 444/453 Drum Storage Area (SWMU 182) and Inactive 444/447 Waste Storage Area (SWMU 208)

2.9 INACTIVE D-836 HAZARDOUS WASTE TANK (SWMU 206)

Two borings are proposed for SWMU 206 during Phase IA (see Figure 2-8). Both borings are located within the area determined to be the previous location of the mobile tank to characterize potential contamination within the SWMU. Two interior borings are judged to be sufficient since the tank reportedly contained only high conductivity water. Samples will be collected at soil depths of 0 to 1 ft and 4 to 5 ft. An optional intermediate-depth soil sample will be collected if contamination is suggested by real-time monitoring during sampling.

2.10 INACTIVE 444 ACID DUMPSTER (SWMU 207)

Two borings are proposed for SWMU 207 during Phase IA (see Figure 2-9). One boring is located outside of the concrete berm south of the SWMU, offset 1 ft from the berm, to document the presence or absence of contamination at the SWMU boundary. The other boring is located in the center of the concrete pad to characterize the nature of potential contamination in the SWMU. Two borings are considered to be sufficient to characterize this SWMU because of its small size (10 ft by 10 ft). Samples will be collected from the overlying pavement and from the soil at depths of 0 to 1 ft and 4 to 5 ft. An optional intermediate-depth soil sample will be collected if contamination is suggested by real-time monitoring during sampling.

2.11 INACTIVE 444/447 WASTE STORAGE AREA (SWMU 208)

Six borings are proposed for SWMU 208 during Phase 1A (see Figure 2-7). Four borings located at the perimeter of the SWMU to document the presence or absence of contamination at the boundary of the SWMU. One boring is located in the center of the SWMU to characterize potential contamination. The sixth boring is located at the outlet of a culvert that drains surface water from SWMU 208 and SWMU 182 as well. Samples will be collected from the overlying asphalt pavement where present, and at soil depths of 0 to 1 ft and 4 to 5 ft. An optional intermediate-depth soil sample will be collected if contamination is suggested by real-time monitoring during sampling.

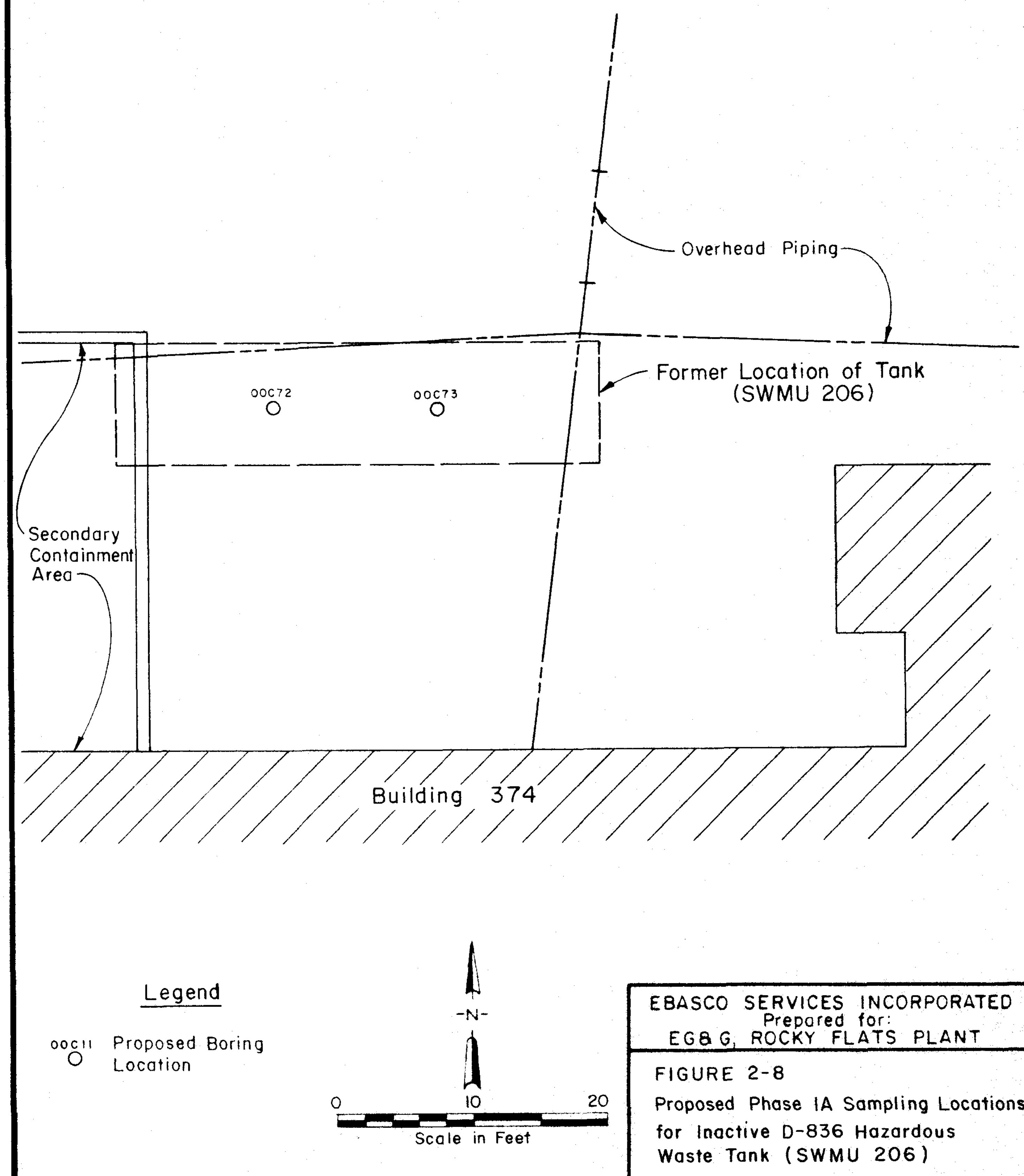

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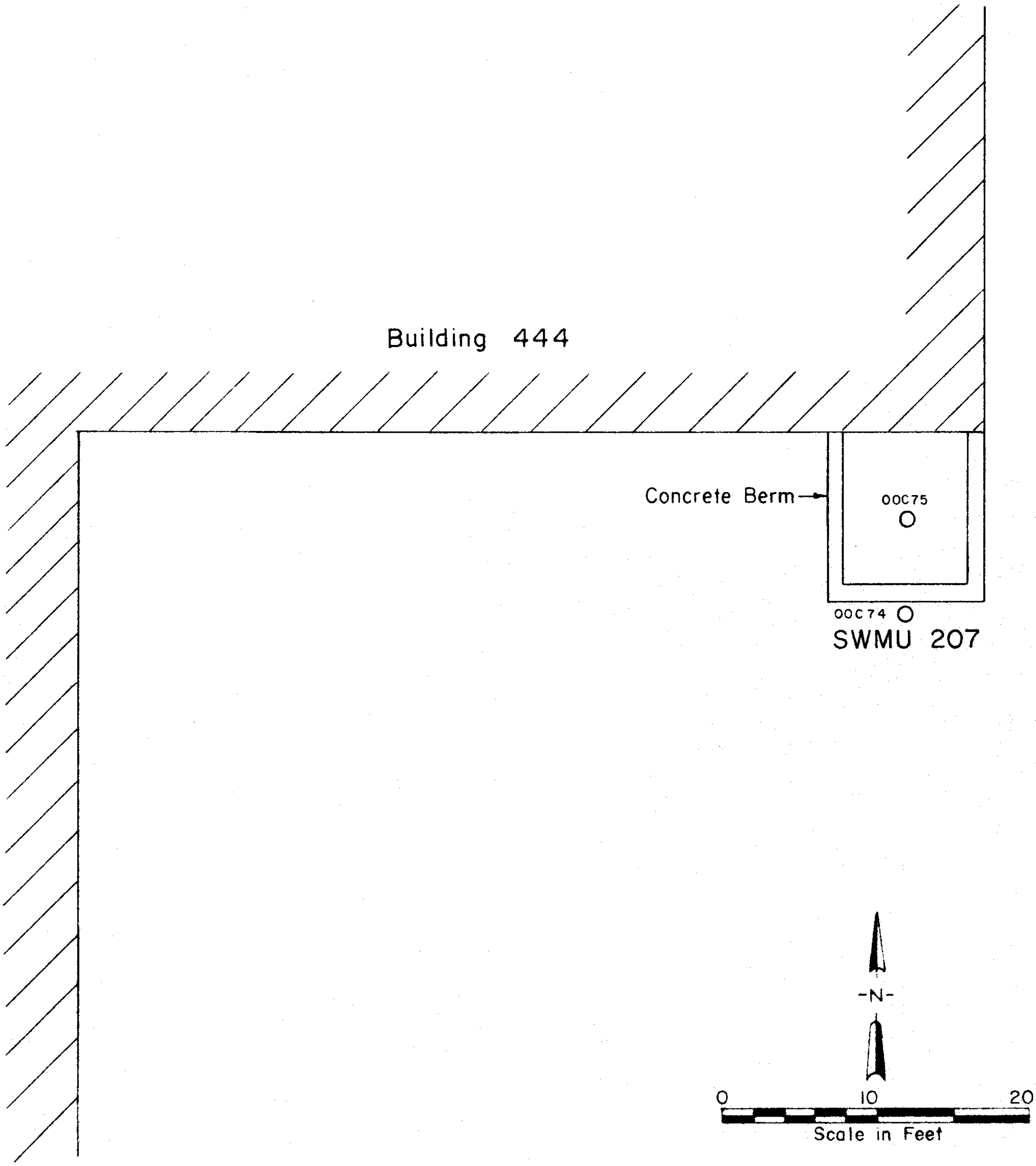
FIGURE 2-8
Proposed Phase IA Sampling Locations for Inactive D-836 Hazardous Waste Tank (SWMU 206)



Legend

00C11 Proposed Boring Location

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FIGURE 2-9

Proposed Phase IA Sampling Locations for Inactive Building 444 Acid Dumpsters (SWMU 207)

2.12 UNIT 15, PAD 904, PONDCRETE STORAGE (SWMU 213)

Twenty borings are proposed for SWMU 213 during Phase IA (see Figure 2-10). Nine are located outside of the perimeter berm of the asphalt pad, offset 1 ft from the berm and at a spacing of approximately 150 ft. These borings will document the presence or absence of contamination beyond the boundary of the SWMU. Five borings are proposed for the interior portion of the Pad (add to table). Waste presently stored on the Pad will be removed prior to Phase IA sampling. Samples from borings will be collected from the overlying pavement and from the soil at depths of 0 to 1 ft and 4 to 5 ft. Three borings are located along drainage ditches near the pad to document potential surface water dispersion of contaminants. Three samples will be located west of the 904 Pad, to confirm reports of stockpiling of contaminated soil west of the Pad during Pad construction. Samples from the ditch borings and the area west of the Pad will be collected at soil depths of 0 to 1 ft and 4 to 5 ft. An optional intermediate-depth soil sample will be collected if contamination is suggested by real-time monitoring during sampling.

2.13 UNIT 25, 750 PAD PONDCRETE AND SALTCRETE STORAGE (SWMU 214)

Twenty-one borings are proposed for SWMU 214 during Phase IA (see Figure 2-11). Twelve are located outside of the perimeter berm of the asphalt pad, offset 1 ft from the berm and at a spacing of 150 ft. These borings will document the presence or absence of contamination beyond the boundary of the SWMU. Five borings are proposed in the interior portion of the pad (add to table) Waste currently stored at the pad will be removed prior to Phase IA sampling. Samples from perimeter borings will be collected from the overlying pavement and from the soil at depths of 0 to 1 ft and 4 to 5 ft. Three borings are located along drainage ditches along and downstream from the pad to document potential surface water dispersion of contaminants. Samples from the ditch borings will be collected at soil depths of 0 to 1 ft and 4 to 5 ft. An optional intermediate-depth soil sample will be collected if contamination is suggested by real-time monitoring during sampling. A sediment sample will be collected from the drainage outfall located immediately east and across the street from the pad.

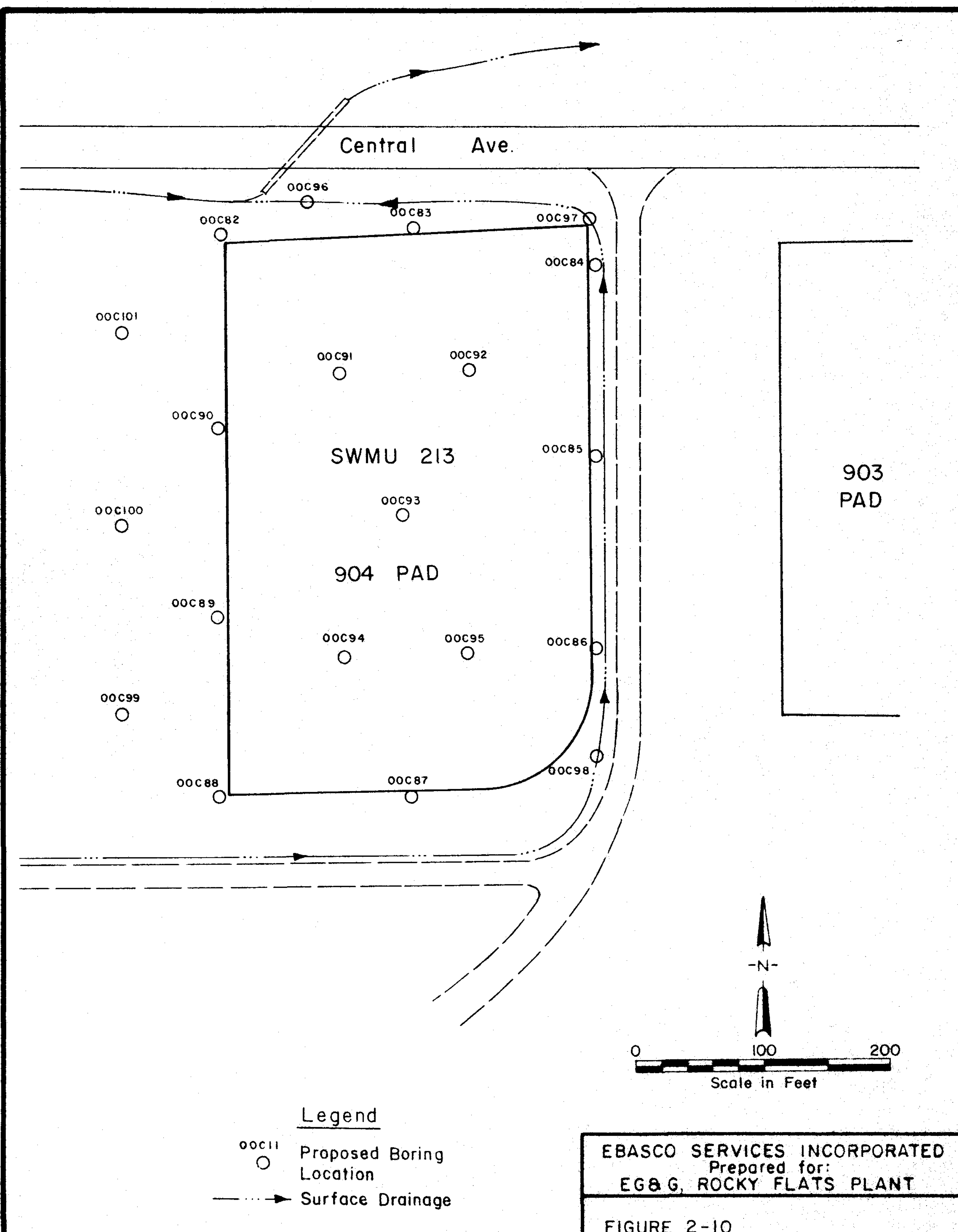

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FIGURE 2-10

Proposed Phase IA Sampling Locations For Unit 15, 904 Pad Pondcrete Storage (SWMU 213)

3.0 SAMPLING DESIGNATION

All sample documentation generated for this RFI/RI effort will conform to the input requirements of the Rocky Flats Environmental Data System (RFEDS) database. Each sample will be designated with a nine character sample number consisting of a two-letter prefix identifying the media sampled (SB for soil bores; SS for stream sediments), a five-digit number, and a two-letter suffix identifying the contractor (e.g., EB for EBASCO). One sample number (SB00001EB) will be required for each sample generated, including duplicates and field blanks. In this manner, 99,999 unique sample numbers are available for each contractor that contributes sample data to the database. A block of numbers will be reserved for use in Phase I RFI/RI sampling for OU 3. Boring numbers will be developed independently of the sample number for a given bore.

In addition to chain-of-custody documentation, a single Sample Identification Sheet will accompany each sample from collection until shipment to the analytical laboratory. The Sample Identification Sheet will document pertinent field data (bore number, date/time collected, visual observations of soil type, etc.). The Sample Identification Sheet will provide a format for field data collection to support documentation for the RFEDS. Following shipment of the samples for analysis, Sample Identification Sheets will be reviewed by the Field QA Officer as a check for errors and completeness. The contractor will enter the data sheets into an RFEDS compatible format using the software Oracle™. Field information required for the database is presented in Table 3-1.

SAMPLE COLLECTION LOG

PROJECT No.: ____________ PROJECT NAME: ____________
SAMPLE No.: ____________
COLLECTION DATE: ____________ QUARTER: ____________
TYPE: SB PURPOSE: ____________
BORING No.: ____________
NORTH OR Y: ____________ EAST OR X: ____________
SAMPLE LOCATION: ____________
COMPOSITE (Y/N):
COMPOSITE DESC: ____________
QC TYPE: ____________ QC PARTNER: ____________
COLLECTION METHOD: ____________
SAMPLE TEAM LEADER: ____________
SAMPLE TEAM MEMBER: ____________ FILM ROLL No: ____________
SAMPLE TEAM MEMBER: ____________ FILM FRAME No: ____________
VOLUME COLLECTED: ______ UNITS: ____ FILM FRAME No: ____________
PREPARED BY: ____________

SUBSURFACE SOIL SAMPLE RESULTS

SAMPLE No.: ____________ BORING No.: ____________
SOIL TYPE: ____________

DEPTH OF TAKE:

START		END	
______	feet	______	feet
______	feet	______	feet
______	feet	______	feet
______	feet	______	feet

HNU BACKGROUND: ______ ppm
READING: ______ ppm

OVA BACKGROUND: ______ ppm
READING: ______ ppm

COMMENTS: ____________

SAMPLE ANALYSIS

SAMPLE No.: ____________
MATRIX: ____________
REQUEST FOR ANALYSIS No: ____________
CHAIN-OF-CUSTODY: ____________
SHIP DATE: 04/27/90

TEST PANELS	LABORATORY	PRESERVATIVE	DUE DATE

4.0 <u>SAMPLING EQUIPMENT AND PROCEDURES</u>

All field sampling and decontamination procedures will be in accordance with the most recent version of the Rocky Flats Plant Environmental Restoration Program Standard Operating Procedures (SOP) (Rockwell, 1989b). The version used to prepare this plan is dated January 1989. Sections of the SOP are referenced where appropriate in the following sections. The SOPs are supplemented by EPA procedures (USEPA, 1987).

4.1 SOIL SAMPLING

Soil bores will be drilled using a 6.25 inch outside diameter (OD) hollow-stem auger. Soil sampling will be conducted by split-spoon sampler or using a 3 inch inside diameter (ID) continuous core sampler 5 ft in length which advances ahead of the auger. Soil samples will be collected from depths of 0 to 1 ft and 4 to 5 ft for Phase IA. Phase IB will consist of samples from 0 to 1 ft, 4 to 5 ft, 9 to 10 ft, and 14 to 15 ft, or the bottom 1 ft interval above the water table, whichever is shallower. Real time monitoring for radionuclides and organic vapors will be conducted in accordance with SOP 6.2 - Health and Safety Monitoring of Organic Vapors with a Photoionization Detector, SOP 6.3 - Health and Safety Monitoring of Organic Vapors with a Flame Ionization Detector, SOP 6.5 - Screening Soil Samples for Alpha Emitters, and SOP 6.7 - Near Surface and Soil Sample Screening for Low-Energy Gamma Radiation Using the FIDLER. If sections outside the sample zones are found that appear to contain radioactive material, these sections will also be sampled.

Sampling will be conducted in the following manner:

1) A clean core barrel is loaded into the hollow-stem auger, and the bore is augered to a depth of 5 ft.

2) The core barrel is removed and opened. The core is screened by a real time monitor for radioactive emissions and organic vapors. The soil is logged by the geologist (SOP 5.1 - Soil and Rock Borehole Logging and Sampling). Zones of detection are sampled for radionuclide and/or organic analyses.

3) Composite samples consisting of material from 0 to 1 ft and 4 to 5 ft are taken for TAL and TCL analysis. Sample containers will be filled in the following

order: volatile organics, semivolatile organics, inorganics, metals, and radionuclides.

At sites covered with a layer of asphalt or concrete, two small diameter, approximately 1 inch, core plugs will be taken from the core location. These samples will be analyzed for radionuclides and metals. Due to the high levels of naturally occurring metals in concrete, a concrete plug will be taken away from the area of possible contamination to provide a reference sample.

All sampling equipment will be decontaminated after each use in accordance with the SOPs.

4.2 SOIL GAS SAMPLING

Soil gas sampling will be conducted in accordance with SOP 5.4 - General Soil Gas Sampling and Field Chemical Analysis.

Soil gas samples will be collected by advancing a 5/8 inch diameter solid steel probe 4 ft into the ground. (If refusal is reached prior to 4 ft but deeper than 2 ft, a sample will be collected at that depth.) The steel probe will be removed and a slightly larger diameter sampling probe will be inserted 2 ft into the hole. A vacuum pump will be attached to the sampling probe and a minimum of 10 volumes of air will be purged from the probe. A soil gas sample will be collected by piercing the tubing between the sampling probe and vacuum pump and extracting 1.0 ml of air with a Hamilton 1.0 ml gas-tight sampling syringe. The sample will then be injected into a portable gas chromatograph (GC) for analysis. If soil gas samples are to be collected beneath asphalt or concrete, an electrical rotary hammer will be used to open a hole to the soil surface.

4.3 WELL DRILLING, COMPLETION, AND DEVELOPMENT

All well drilling, completion, and development will be in accordance with SOP 4.1 - Soil Boring, SOP 4.3 - Monitoring Well Installation, and SOP 4.4 Monitoring Well Development. All sampling equipment will be decontaminated after each use and all well materials will be decontaminated prior to placement in the borehole.

Well Drilling and Installation

After soil sampling is completed, the boreholes will be overdrilled and deepened with a 8 inch ID hollow-stem auger. Wells will be installed in the open borehole or within the hollow-stem auger, if borehole stability is a problem. The well will be constructed of 4 inch inside diameter (ID) schedule 40, threaded, flush-jointed, PVC screen and casing. The screen will be slotted PVC pipe. The screen slot size will be determined based on the characteristics of the aquifer material. The maximum screen length will be 10 feet and the screen will extend above the water table to allow for seasonal fluctuation. A silica sand pack will be placed in the borehole around the screen to a height of 0.5 to 1 ft above the top of the screen. A 0.5 to 3 ft seal consisting of bentonite pellets will be placed above the sand pack. The bentonite will be activated with water from the well. The remaining borehole annulus will be filled to the surface with a cement-bentonite grout. After the grout has been allowed to set up (a minimum of 24 hours), a 8 inch steel protective casing with locking cap will placed over the well and a concrete apron and guard posts will be placed around the well. A weep hole will be drilled in the protective casing. All well completion information will be recorded on a Borehole/Well Construction Data Log form.

Well Development

All new wells will be developed no sooner than 24 hours after completion. Development will be completed by rawhiding. Initial color, turbidity, clarity, and odor will be noted. Three well bore volumes will be removed and the amount of water removed after each well bore volume will be noted. The water level will then be allowed to recover to 75 per cent of the original static level and the turbidity again measured. If the turbidity has stabilized, the well is considered fully developed. If the turbidity has not stabilized, additional well bore volumes will be removed and stabilization is achieved. All observations and measurements will be recorded on the Well Development Summary Sheet.

4.5 GROUND WATER SAMPLING

Ground water sampling will be in accordance with SOP 2.1 - Presample Purging of Wells, SOP 2.2 - Field Measurements on Ground and Surface Water Samples, SOP 2.3 -

Sampling Monitoring Wells with a Bladder Pump, and SOP 2.8 - Sampling for Volatile Organics. All sampling equipment will be decontaminated after each use.

Presample Purging

Presample purging of the monitoring wells will be conducted with either a peristaltic pump, bladder pump, or bailer, depending on hydrologic conditions encountered in the individual wells. Prior to purging, the total depth of the well and the water level will be determined using an electronic water level indicator (m-scope). The volume of liquid in the well will then be calculated. If the pump is used, it will be lowered to the middle of the screen interval. If a bailer is used, it will remove water from the top of the water column. One to three well bore volumes will be removed from the well depending on the productivity of the aquifer. The amount of water removed and the purging time will be recorded.

Well Sampling

The wells will be sampled with a bladder pump within 24 hours after presample purging. The pump will be lowered down the well until the bottom (intake) of the well is just at the top of the well screen. The sample will be collected from the discharge pipe of the pump. Sample containers will be filled in the following order: volatile organics, semivolatile organics, inorganics, metals, and radionuclides.

Measurements of pH, conductivity, temperature, and alkalinity will be taken in the field prior to sample collection. All meters used for these measurements will be calibrated immediately before the measurement is taken. All field measurements and calibrations will be recorded on the Groundwater Level and the Groundwater Quality Sampling Record forms.

4.6 IDENTIFYING SAMPLE LOCATIONS

All proposed sample, borehole, and well locations will be marked before sampling begins by placing a wooden stake in the ground. At the completion of sampling, the sample and borehole locations will be surveyed for location and elevation relative to a permanent or semipermanent landmark at the site (i.e. telephone post, building corner, etc.). All new wells will be surveyed for location and elevation to 0.01 foot in a coordinate system designated by RFP.

4.7 DECONTAMINATION PROCEDURES

Decontamination of equipment and personnel will be in accordance with SOP 1.6 - General Equipment Decontamination, SOP 1.8 - Personnel Decontamination -- Level D Protection, SOP 1.9 - Personnel Decontamination -- Level C Protection, and SOP 1.10 - Personnel Decontamination -- Level B Protection.

Equipment Decontamination

All large equipment (drill rigs, trucks, etc.) will be decontaminated at a decontamination pad. Equipment will be decontaminated by:

1. Remove all solid particles by brushing and then rinsing with tap water. For drilling equipment, steam cleaning is necessary.

2. Wash equipment with soap or detergent solution.

3. Rinse with tap water by submerging or spraying.

4. Rinse thoroughly with distilled water.

5. Air dry equipment.

6. When radiation screening is required, screen the equipment with a radiation detector according to SOP 1.7 - Sampling for Removable Alpha Contamination, SOP 6.4 - Total Alpha Surface Contamination Measurements, or SOP 6.12 - Radon-222 Flux Measurements Using Charcoal Canisters. If activity above the limits for unrestricted use is detected, repeat steps 1-5.

7. Samples of drippings from the last rinse in step 4 will periodically be collected and analyzed to verify the effectiveness of the decontamination procedure. This type of sample is called a decontamination or rinse blank.

8. Upon termination of the borehole, decontaminate all drilling equipment. Decontamination will include:

   a. A rinse with the steam cleaner using organic-free water.

   b. Scrubbing with brushes using a solution of organic-free water and an alkaline detergent.

c. A final rinse with the steam cleaner using organic-free water.

9. Well casing and screen will be decontaminated prior to placement in the borehole. The procedures listed in Step 8 will be followed.

10. Cover drilling equipment with a clean sheet of plastic after it is decontaminated. Install wet casing and screen in borehole.

<u>Sample Container Decontamination</u>

Sample containers will be decontaminated immediately after the samples are collected. For sample bottles, the decontamination will consist of immersing the bottle up to the neck in a soap and water solution followed by a tap or distilled water rinse. Solvents will not be used to wash sample containers.

<u>Personnel Decontamination</u>

The level of personnel decontamination will depend on the level of protection used. Details of personnel decontamination are presented in the SOPs and in the Site Health and Safety Plan.

5.0 SAMPLE HANDLING AND ANALYSIS

Sample handling will be in accordance with SOP 1.3 - Sample Control and Documentation, SOP 1.4 - Sample Containers and Preservation, and SOP 1.5 - Guide to the Handling, Packaging, and Shipping.

5.1 SAMPLE CONTROL AND DOCUMENTATION

All pertinent information pertaining to the field operation will be recorded in a bound logbook with consecutively numbered pages. The logbook will include: date and time of entry; purpose of sampling; name and address of field contact; site identification; type of process producing waste (if known); type of waste (sludge, soil, wastewater, groundwater, etc.); description of sample waste components and concentrations; sample identifier and size of sample take; description of sampling point; date and time for collection of sample; collector's sample identification; references of the sampling site (maps or photographs); field observations and sampling locations; associated field measurements; method of sample collection, preservation techniques, and any deviations or anomalies; transfer of logbook to individuals designated for specific tasks of the project; and any uncompleted work.

Photographs will be documented with: date and time; signature of photographer; name and general direction faced and description of the subject; distance from photographer to object; location at the site; and sequential number of photograph and the roll number.

Sample labels or tags will be attached to all samples collected immediately after the container has been decontaminated. The label will contain the sample number, location, site, analysis to be performed, preservative, and the signature of the sampler(s).

Chain-of-custody will be maintained throughout the sample preparation procedure as described below:

- All information required on the sample label or tag, including the signatures of the sampling team members, analysis requested, and a predesignated location description will be filled out in the field.

- Prior to relinquishing samples for packaging and shipment, one member of the sampling team will transfer all data contained on the sample label or tags to a chain-of-custody record, which the sampling team members must sign.

- The individual who prepared the chain-of-custody record will relinquish the samples to the sample coordinator.

- The sample coordinator will package the samples for shipment making sure that all chain-of-custody records and custody seals are cross referenced and recorded and that all sample documentation paperwork is enclosed.

- If samples are stored temporarily prior to shipment, they will be kept cool (4°C) and placed in a secured storage area. Coolers will be sealed and custody seals affixed just prior to shipment.

5.2 SAMPLE CONTAINERS AND PRESERVATION

Sample containers will be received in the field precleaned to EPA specifications. Preservatives will be added in the field immediately after the sample is collected. Tables 5-1 through 5-4 list the analyte, sample containers, sample volumes, preservatives, and holding times for the soil and water samples.

5.3 HANDLING, PACKAGING, AND SHIPPING

The sample coordinator will prepare shipping documentation and package the containers for shipment according to the following procedures:

- Check to make sure that the sample is properly preserved when preservation is necessary. Tighten cap securely and seal with tape.

- Make sure sample labels or tags are securely attached to the sample container; place each container in a zip-lock baggie, ensuring that labels can be read.

- Place sample in a cooler lined with a large polyethylene bag. Pack with enough vermiculite or equivalent absorbent material to minimize the possibility of container breakage and maintain at 4°C with cold packs or ice sealed in plastic bags for low concentration samples, where appropriate. Fill remaining space in cooler with additional packing material.

- Medium and high concentration samples will be packaged one bottle per paint can with the excess space filled with vermiculite. The sample number and proper DOT hazard classification, when appropriate, will be marked on each can.

- Seal large bag.

Table 5-1
Analysis Plan for Soil/Sediment/Waste Samples [a]

Analyte	Method	Detection Limit	Sample Container	Sample Amount (g)	Preservations	Holding Time (Days)	Reporting Units
TCL Volatile	EPA SOW [b]	x [d]	4-ounce glass	5	4° C	14	ug/kg [f]
TCL Base/neutral/acid	EPA SOW	x [d]	8-ounce glass	10-30	4° C	7/40	ug/kg [f]
TCL Pesticide/PCB	EPA SOW	x [d]	8-ounce glass	10-30	4° C	7/40 [e]	ug/kg [f]
TAL Inorganic	EPA SOW	x [d]	8-ounce glass	10-30	4° C	180	mg/kg [f]
Non-TAL Metals [c]	EPA 7000 & 6010 Series	x [d]	8-ounce glass	10-30	4° C	180	mg/kg [f]
Reactivity	EPA 9010 and 9030	Ref. b	8-ounce glass	------	4° C	N/A	ug/l
Chloride	EPA 9251	60 u/g [h]	8-ounce glass	10-20	4° C	N/A	mg/kg [f]
Sulfate	EPA 9038	60 ug/g [h]	8-ounce glass	10-20	4° C	N/A	mg/kg [f]
Nitrate + Nitrite	EPA 353.2 [g]	60 ug/g [h]	8-ounce glass	10	4° C	N/A	mg/kg [f]
Cyanide	EPA 9010	x [d]	8-ounce glass	5	4° C	14	mg/kg [f]
Sulfide	EPA 9030	4 ug/g	8-ounce glass	10	4° C	N/A	mg/kg [f]
% Moisture/% Solids	EPA 160.3	10 mg	8-ounce glass	5-10	4° C	N/A	%
Hexavalent chromium	S.M. 312B [i]	1 ug/g [h]	8-ounce glass	50-250	4° C	1	mg/kg [f]
pH	U.S.D.A. [j]	N/A	8-ounce glass	10	4° C	N/A	pH Units

TCL - Target Compound List
TAL - Target Analyte List
N/A - Not applicable
[a] The sampling plans will define the actual suite of parameters to be analyzed for specific samples.
[b] EPA, 1987a; EPA, 1987b
[c] Includes cesium, lithium, molybdenum, strontium, and tin which are non-TAL metals.
[d] See ER QA/QC Plan
[e] Extraction within 7 days, analysis within 40 days of extraction.
[f] Reported as dry weight, percent moisture reported separately.
[g] Soil/sediments will be leached with laboratory reagent water (10 g soil to 50 ml water) and the water extract will be analyzed using procedure in "Methods for Chemical Analysis of Water and Wastes," 1983; EPA 600/4-79-020.
[h] These are estimated detection limits.
[i] Soil/sediment will be leached with laboratory reagent water (5 g soil and 100 ml water) by shaking for 2 hours, and the water extract filtered and subsequently analyzed. This is in accordance with Method 312B in Standard Methods for Examination of Water and Wastewater, 16th Edition.
[j] U.S.D.A. Agricultural Handbook #60, Method 21C.

Table 5-2
Plan for Radiological Analysis of Soils/Sediments

Analyte	Method[a]	Detection Limit[b]	Sample Container[c]	Sample Weight (g)	Preservations	Holding Time (Days)	Reporting Units
Gross alpha/beta	1, 2, 3, 4, 6, 7, 8, 9	Gross a = 4 pCi/g dry Gross b = 10 pCi/g dry	1-liter glass	0.1	N/A	N/A	pCi/g dry
Plutonium-239 + 240	10, 11	0.03 pCi/g dry	1-liter glass	5	N/A	N/A	pCi/g dry
Americium-241	11, 12	0.02 pCi/g dry	1-liter glass	5	N/A	N/A	pCi/g dry
Isotopic Uranium	1, 3, 4, 7, 8, 9	U-233, 234 = 0.3 pCi/g dry U-235 = 0.3 pCi/g dry U 238 = 0.3 pCi/g dry	1-liter glass	1	N/A	N/A	pCi/g dry
Strontium-90	1, 3, 4, 8	1 pCi/g dry	1-liter glass	1	N/A	N/A	pCi/g dry
H-3	3	400 pCi/ml moisture	1-liter glass	8 ml moisture	N/A	N/A	pCi/ml moisture
Cesium-137	8	0.1 pCi/g dry	1-liter glass	100	N/A	N/A	pCi/g dry
Radium-226	8	0.5 pCi/g dry	1-liter glass	100	N/A	N/A	pCi/g dry
Radium-228	8	0.5 pCi/g dry	1-liter glass	100	N/A	N/A	pCi/g dry

U - Uranium
N/A - Not applicable
[a] See Notes, Table 5-4
[b] See Notes, Table 5-4
[c] Aliquots for radiochemical analysis will come from the same container.

Table 5-3
Analysis Plan for Aqueous Samples [a]

Analyte	Method	Detection Limit	Sample Container	Sample Volume	Preservations	Holding Time (Days)	Reporting Units
TCL Volatile	EPA SOW [b]	x [e]	40-ml vial (2) w/Teflon-lined silicon rubber septum	40 ml	4° C [j]	14	ug/l
TCL Base/neutral/acid [c]	EPA SOW	x [e]	1-liter amber glass	1 l	4° C	7/40 [i]	ug/l
TCL Pesticide/PCB	EPA SOW	x [e]	1-liter amber glass	1 l	4° C	7/40 [i]	ug/l
TAL Inorganic	EPA SOW	x [e]	500-ml plastic	> 50 ml [m]	pH< 2,w/HNO_3 [k]	180	mg/l
Non-TAL Metals [d]	EPA 6000 - 7000 series	x [e]	500-ml plastic	> 50 ml [m]	pH< 2,w/HNO_3 [k]	180	mg/l
Cyanide	EPA 9010	x [e]	1-liter plastic	0.5 l	pH> 12,w/NaOH	14	mg/l
pH [f]	EPA 9840	0.1 pH Unit	500-ml plastic	N/A	None	Field meas.	pH Unit
Specific conductivity [f]	EPA 9050	1	500-ml plastic	N/A	None	Field meas.	umho/cm
Temperature [f]	EPA 9050	0.1	500-ml plastic	N/A	None	Field meas.	° C
Dissolved Oxygen [f]	EPA 9050	0.5	500-ml plastic	N/A	None	Field meas.	mg/l
TDS	EPA 160.1 [j]	5	500-ml plastic	50 ml [l]	4° C	7	mg/l
TSS	EPA 160.2 [j]	10	500-ml plastic	100 ml [l]	4° C	7	mg/l
Chloride, sulfate	EPA 9251 EPA 9038	5	500-ml plastic	5 ml, 15 ml [l]	4° C [k]	28	mg/l
Oil & grease	EPA 9070	5	1-liter amber glass	1 l	pH< 2, w/N_2SO_4	28	mg/l
Carbonate/bicarbonate [g]	S.M. 403 [h]	10	500-ml plastic	20 ml [l]	4° C [k]	14	mg/l
Nitrate + Nitrite	EPA 353.2	5	100-ml plastic	5 ml	4° C [k], pH < 2 w/N_2SO_4	28	mg/l
Hexavalent chromium	S.M. 312B [h]	0.01	500-ml plastic	100 ml	4° C [k]	1	mg/l

TCL - Target Compound List
TAL - Target Analyte List
N/A - Not applicable
TDS - Total dissolved solids
TSS - Total suspended solids
[a] The sampling plans will define the actual suite of parameters to be analyzed for specific samples.
[b] EPA, 1987a; EPA, 1987b
[c] The TCL base/neutral/acid fractions analytical parameters are the HSL semivolatiles.
[d] Includes cesium, lithium, molybdenum, strontium, and tin which are non-TAL metals.
[e] See ER QA/QC Plan
[f] Field measurements
[g] These are reported as carbonate and bicarbonate alkalinity.
[h] Standard Methods for Examination of Water and Wastewater, 16th Edition.
[i] Extraction within 7 days, analysis within 40 days of extraction.
[j] Methods for Chemical Analysis of Water and Wastes, 1983; EPA 600/4-79-020.
[k] Sampling Plan may specify filtered sample. Sampling will be done in field within 2 hours of sample collection; preservatives added after filtering.
[l] Aliquot for analysis of TDS, TSS, chloride, sulfate, carbonate/bicarbonate, and hexavalent chrome can be drawn from one 500-ml plastic container.
[m] Aliquots for analysis of TAL inorganics and non-TAL metals can be drawn from one 500-ml plastic container.

Table 5-4
Plan for Radiological Analysis of Aqueous Samples

Analyte	Method [a]	Detection Limit [b]	Sample Container [c]	Sample Volume [c]	Preservations	Holding Time (Days)	Reporting Units
Gross alpha/beta	1, 2, 3, 4, 6, 7, 8, 9	Gross a = 2 pCi/l Gross b = 4 pCi/l	1-gallon plastic	0.2 l	HNO_3 to pH < 2	180	pCi/l
Tritium	1, 2, 3, 8	400 pCi/l	100-ml glass	0.008 l	No preservation	None	pCi/l
Plutonium-239 + 240	10, 11	0.01 pCi/l	1-gallon plastic	2.5 l [e]	HNO_3 to pH < 2	180	pCi/l
Americium-241	11, 12	0.01 pCi/l	1-gallon plastic	2.5 l [e]	HNO_3 to pH < 2	180	pCi/l
Isotopic Uranium	1, 3, 4, 7, 8, 9	U-233, 234 =0.6 pCi/l U-235 = 0.6 pCi/l U 238 = 0.6 pCi/l	1-gallon plastic	0.500 l	HNO_3 to pH < 2	180	pCi/l
Strontium-90	1, 3, 4, 8	1 pCi/l	1-gallon plastic	1.000 l [e]	HNO_3 to pH < 2	180	pCi/l
Cesium-137	8	1 pCi/l	1-gallon plastic	1.000 l [e]	HNO_3 to pH < 2	180 [d]	pCi/l
Radium-226	1, 2, 3, 8	0.5 pCi/l	1-gallon plastic	1.000 l	HNO_3 to pH < 2	180 [d]	pCi/l
Radium-228	1, 2, 3, 8	1 pCi/l	1-gallon plastic	1.000 l	HNO_3 to pH < 2	180 [d]	pCi/l

Note: Parameters for total analyses are presented in the field parameters for dissolved analyses. Parameters for dissolved analyses are first filtered through a 0.45 u membrane filter and then preserved in the field.

U - Uranium

HNO_3 - Nitric acid

N/A - Not applicable

[a] See Notes

[b] See Notes

[c] With the exception of tritium, there will be more than sufficient sample volume to analyze all the radionuclides by filling two one-gallon containers or equivalent.

[d] If gross alpha > 5 pCi/l, analyze for Ra-226; if Ra-226 > 3 pCi/l, analyze for Ra-228. Methodology is Reference 13.

[e] Both plutonium and americium can be analyzed from on 2.5-l sample. Both strontium and cesium can be analyzed from one 1-l sample.

Table 5-4 Continued
Radiological Analysis - Method References
NOTES

1. U.S. Environmental Protection Agency, 1979. Radiochemical Analytical Procedures for Analysis of Environmental Samples, Report No. EMSL-LY-0539-1, Las Vegas, NV, U.S. Environmental Protection Agency.

2. American Public Health Association, American Water Works Association, Water Pollution Control Federation, 1985. Standard Methods for the Examination of Water and Wastewater, 16th ed., Washington, D.C., Am. Public Health Association.

3. U.S. Environmental Protection Agency, 1976. Interim Radiochemical Methodology for Drinking Water, Report No. EPA-600/4-75-008. Cincinnati, U.S. Environmental Protection Agency.

4. Harley, J.H., ed., 1975. HASL Procedures Manual, HASL-300; Washington D.C., U.S. Energy Research and Development Administration.

5. "Radioassay Procedures for Environmental Samples," 1967. USDHEW, Section 7.2.3.

6. "Handbook of Analytical Procedures," USAEC, Grand Junction Lab., 1970, page 196.

7. "Prescribed Procedures for Measurement of Radioactivity in Drinking Water," EPA-600/4-80-032, August 1980, Environmental Monitoring and Support Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Cincinnati, Ohio 45268.

8. "Methods for Determination of Radioactive Substances in Water and Fluvial Sediments," U.S.G.S. Book 5, Chapter A5, 1977.

9. "Acid Dissolution Method for the Analysis of Plutonium in Soil," EPA-600/7-79-081, March 1979, U.S. EPA Environmental Monitoring and Support Laboratory, Las Vegas, Nevada, 1979.

10. "Procedures for the Isolation of Alpha Spectrometrically Pure Plutonium, Uranium, and Americium," by E.H. Essington and B.J. Drennon, Los Alamos National Laboratory, a private communication.

11. "Isolation of Americium form Urine Samples," Rocky Flats Plant, Health, Safety, and Environmental Laboratories.

12. "Radioactivity in Drinking Water," EPA 570/9-81-002.

Table 5-4 Continued

NOTES
Lower Limits of Detection

The detection limits presented were calculated using the formula in N.R.C. Regulatory Guide 4.14, Appendix Lower Limit of Detection, pg. 21, and follow:

$$LLD = \frac{4.66\,(BKG/DUR)^{1/2}}{(2.22)(Eff)(CR)(SR)(e\text{-}xt)(Aliq)}$$

Where:

LLD	=	Lower Limit of Detection in pCi per sample unit
BKG	=	Instrument Background in counts per minute (CPM)
Eff	=	Counting efficiency in cpm/disintegration per minute (dpm)
CR	=	Fractional radiochemical yield
SR	=	Fractional radiochemical yield of a known solution
x	=	The radioactive decay constant for the particular radionuclide
t	=	The elapsed time between sample collection and counting
ALIQ	=	Sample Volume
DUR	=	Duration time in minutes

In that LLD is a function of many variables including sample matrix, sample volume, and other factors, the limits present are only intended as guides to order-of-magnitude sensitivities and in practice can easily change by a factor of two or more, even for the conditions specified.

Source: ER QA/QC Plan (1988a)

- Put chain-of-custody forms and traffic reports in manila envelope; place envelope in zip-lock baggie and tape to inside of cooler lid.

- Close cooler and seal shut with strapping tape; if cooler has a drain port, seal it shut with tape; place custody seal across closure of front of cooler and across hinge area at back of cooler.

- Affix airbill with shipper's and consignee's addresses to top of cooler.

The RFP Sampling Coordinator will be provided with the following information:

- Name of laboratory(s)
- Date of shipment
- Carrier, airbill number
- Number of matrices of samples shipped
- Information regarding changes or delays pertaining to the activity.

5.4 QA SAMPLES AND ANALYTES

Quality Assurance and analysis will be in accordance with the Quality Assurance/Quality Control Plan (1989).

For all samples, one duplicate (of the same type and container size) will be collected for every 20 samples (or portion thereof) collected in each sampling activity. Duplicate samples will be collected by alternately filling two sets of sample bottles from the same sample unit for each set of parameters.

For all samples, one rinse blank will be collected for every 20 samples (or portion thereof) collected for each sampling activity. After decontamination, rinse blanks will be collected by pouring distilled water over the sampling equipment and collecting the rinsate.

Trip blanks will be submitted at a rate of one per each day of sampling. Trip blanks will be prepared with distilled/deionized organic free laboratory water for both aqueous and soil/sediment samples.

All analysis will be in accordance with the Rocky Flats QA/QC Plan (1989a). Table 5-5 lists the analytical parameters for this investigation.

Table 5-5 Analytical Parameters

Target Compound List (TCL) - Volatile Organics	
Chloromethane	1,1,2,2-Tetrachloroethane
Bromomethane	1,2-Dichloropropane
Vinyl Chloride	trans-1,2-Dichloropropene
Chloroethane	Trichloroethene
Methylene Chloride	Dibromochloromethane
Acetone	1,1,2-Trichloroethane
Carbon Disulfide	Benzene
1,1-Dichloroethene	cis-1,3-dichloropropene
1,1-Dichloroethane	Bromoform
Total 1,2-Dichloroethene	2-Hexanone
Chloroform	4-Methyl-2-pentanone
1,2-Dichloroethane	Tetrachloroethene
2-Butanone	Toluene
1,1,1-Trichloroethane	Chlorobenzene
Carbon Tetrachloride	Ethyl Benzene
Vinyl Acetate	Styrene
Bromodichloromethane	Total Xylenes
	1,1-Dichloroethane

Target Compound List (TCL) - Pesticides/PCBs	
alpha-BHC	4,4'-DDT
beta-BHC	Endrin Ketone
delta-BHC	Methoxychlor
gamma-BHC (Lindane)	alpha-Chlordane
Heptachlor	gamma-Chlordane
Aldrin	Toxaphene
Heptachlor Epoxide	AROCLOR-1016
Endosulfan I	AROCLOR-1221
Dieldrin	AROCLOR-1232
4,4'-DDE	AROCLOR-1242
Endrin	AROCLOR-1248
Endosulfan II	AROCLOR-1254
4,4'-DDD	AROCLOR-1260
Endosulfan Sulfate	

Table 5-5 Analytical Parameters (Continued)

Target Compound List (TCL) - Semivolatile Organics	
Phenol	Acenaphthene
bis(2-Chloroethyl)ether	2,4-Dinitrophenol
2-Chlorophenol	4-Nitrophenol
1,3-Dichlorobenzene	Dibenzofuran
1,4-Dichlorobenzene	2,4-Dinitrotoluene
Benzyl Alcohol	2,6-Dinitrotoluene
1,2-Dichlorobenzene	Diethylphthalate
2-Methylphenol	4-Chlorophenyl phenyl ether
bis(2-Chloroisopropyl)ether	Fluorene
4-Methylphenol	4-Nitroaniline
N-Nitroso-Dipropylamine	4,6-Dinitro-2-methylphenol
Hexachloroethane	N-nitrosodiphenylamine
Nitrobenzene	4-Bromophenyl Phenyl ether
Isophorone	Hexachlorobenzene
2-Nitrophenol	Pentachlorophenol
2,4-Dimethylphenol	Phenanthrene
Benzoic Acid	Anthracene
bis(2-Chloroethoxy)methane	Di-n-butylphthalate
2,4-Dichlorophenol	Fluoranthene
1,2,4-Trichlorobenzene	Pyrene
Naphthalene	Butyl Benzylphthalate
4-Chloroaniline	3,3'-Dichlorobenzidine
Hexachlorobutadiene	Benzo(a)anthracene
4-Chloro-3-methylphenol(para-chloro-meta-cresol)	bis(2-ethylhexyl)phthalate
2-Methylnaphthalene	Chrysene
Hexachlorocyclopentadiene	Di-n-octyl phthalate
2,4,6-Trichlorophenol	Benzo(b)fluoranthene
2,4,5-Trichlorophenol	Benzo(k)fluoranthene
2-Chloronaphthalene	Benzo(a)pyrene
2-Nitroaniline	Indeno(1,2,3-cd)pyrene
Dimethylphthalate	Dibenz(a,h)anthracene
Acenaphthylene	Benzo(g,h,i)perylene
3-Nitroaniline	

Table 5-5 Analytical Parameters (Continued)

Metals	
Target Analyte List (TAL) - Metals	Other Metals
Aluminum	Molybdenum
Antimony	Cesium
Arsenic	Strontium
Barium	Lithium
Beryllium	Tin
Cadmium	
Calcium	
Chromium	
Cobalt	
Copper	
Iron	
Lead	
Magnesium	
Manganese	
Mercury	
Nickel	
Potassium	
Selenium	
Silver	
Sodium	
Thallium	
Vanadium	
Zinc	
Inorganics	
pH	Sulfide
Nitrate	Percent Solids (water only)
Radionuclides	
Gross Alpha	Plutonium 239+240
Gross Beta	Tritium
Uranium 233+234, 235, and 238	Strontium 89, 90
Americium 241	Cesium 137

6.0 REFERENCES

United States Environmental Protection Agency (USEPA). December 1987. A Compendium of Superfund Field Operations Methods. EPA/540/P-87/001.

United States Environmental Protection Agency (USEPA). October 1988. Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA - Interim Final. EPA/540/G-89/004.

Rockwell International Aerospace Operations. January 1989a. Quality Assurance/Quality Control Plan Environmental Restoration Program Rocky Flats Plant.

Rockwell International Aerospace Operations. January 1989b. Standard Operating Procedures Environmental Restoration Program Rocky Flats Plant.

APPENDIX B

BASELINE RISK ASSESSMENT PLAN (BRAP)

Baseline Risk Assessment

A baseline risk assessment will be prepared for the OU3, Other Outside Closures as part of the Phase II RFI/RI to evaluate the potential threat to the public health and the environment in the absence of remedial action. The baseline risk assessment will provide the basis for determining whether or not remedial action is necessary in the area and serve as the justification for performing remedial action (EPA, 1988a). EPA's interim final "Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual" (EPA, 1989a) provides detailed guidance on evaluating potential human health impacts as part of this baseline assessment. The steps of a Baseline Risk Assessment are shown in Figure 1. The outline to be followed for the Baseline Risk Assessment Report is shown in Appendix I.

Several objectives will be accomplished under the risk assessment task including identification and characterization of the following (EPA, 1988a):

- Toxicity and levels of hazardous and radioactive contaminants present in relevant media (e.g., air, ground water, soil, surface water, sediment, and biota);
- Environmental fate and transport mechanisms within specific environmental media and cross-media fate and transport where appropriate;
- Potential human and environmental receptors;
- Potential exposure routes and extent of actual or expected exposure;
- Extent of expected impact or threat; and the likelihood of such impact or threat occurring (i.e., risk characterization); and
- Level(s) of uncertainty associated with the above.

The risk assessment will address the potential public health and environmental impacts associated with the site under the no-action alternative (no remedial action taken). This assessment will aid in the selection of site remedies based on the contaminants of concern and the environmental media associated with potential risks to public health and the environment.

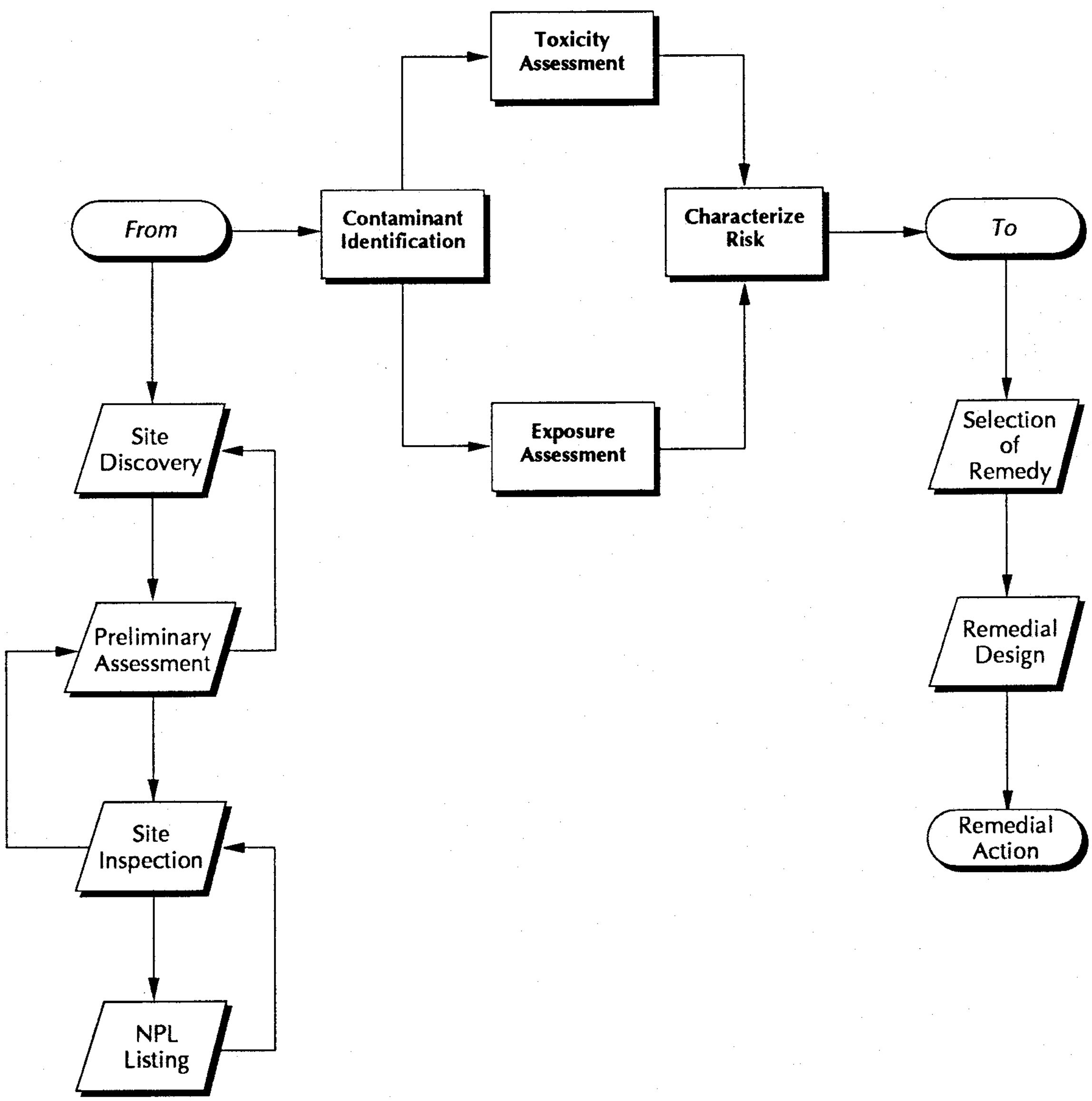

Figure 1 • Baseline Risk Assessment Development Process

During the scoping of the Baseline Risk Assessment, the format of the Baseline Risk Assessment report as well as the references to be utilized during the Baseline Risk Assessment will be discussed with the EPA and the State (IAG, 1989).

The risk assessment process is divided into four tasks (EPA, 1988a), including:

- Contaminant identification;
- Exposure assessment;
- Toxicity assessment; and
- Risk characterization.

The task objectives and description of work for each task are described in the following sections.

Contaminant Identification

The objective of contaminant identification is to screen the information that is available on hazardous and radioactive substances or wastes present at the site and to identify contaminants for the risk assessment process. Previous work characterizing aspects of the Rocky Flats Plant and the surrounding area has been done. Additional sampling and analysis of various media will take place in order to support the human health risk assessment, the environmental assessment, and to further characterize the site. Environmental sampling and analysis will be conducted in accordance with a Quality Assurance Project Plan addressing EPA QAMS-005/80, "Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans" (EPA, 1980). Once all necessary data has been collected and evaluated, reduction in the number of chemical and radiological contaminants identified to a list of "contaminants of concern" will be evaluated in accordance with guidance contained in EPA's interim final "Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual" (EPA, 1989a).

A technical memorandum will be submitted to EPA and the State for review and approval listing the hazardous and radioactive substances present at each site or OU and the contaminants of concern be evaluated with the known corresponding ambient concentrations of these contaminants. This memorandum will be submitted prior to the required submittal of the Baseline Risk Assessment for each OU. Contaminant-specific requirements will also be identified at this time (IAG, 1989).

Exposure Assessment

Exposure is the contact of an organism (humans in the case of health risk assessment) with a chemical or physical agent (EPA 1988b). The objectives of the exposure assessment are to identify actual or potential chemical and radiological exposure pathways, to characterize potentially exposed populations, and to determine the extent of exposure (quantitatively or qualitatively). An exposure pathway is comprised the following elements:

1) A source and mechanism of radioisotope and chemical release to the environment;

2) An environmental transport medium (e.g., air, ground water) for the released constituent;

3) A point of potential contact of humans or biota with the affected medium (the exposure point); and

4) An exposure route (e.g., inhalation of contaminated dust) at the exposure point.

The exposure assessment will be conducted per guidance provided in the "Superfund Exposure Assessment Manual", (EPA, 1988c). Steps involved in the exposure assessment are shown in Figure 2. The exposure assessment process will include the following actions:

- Analyze the probable fate and transport of compounds for both the present and the future uses;
- Identify the human populations in the area, typical activities that would influence exposure, and sensitive population subgroups;

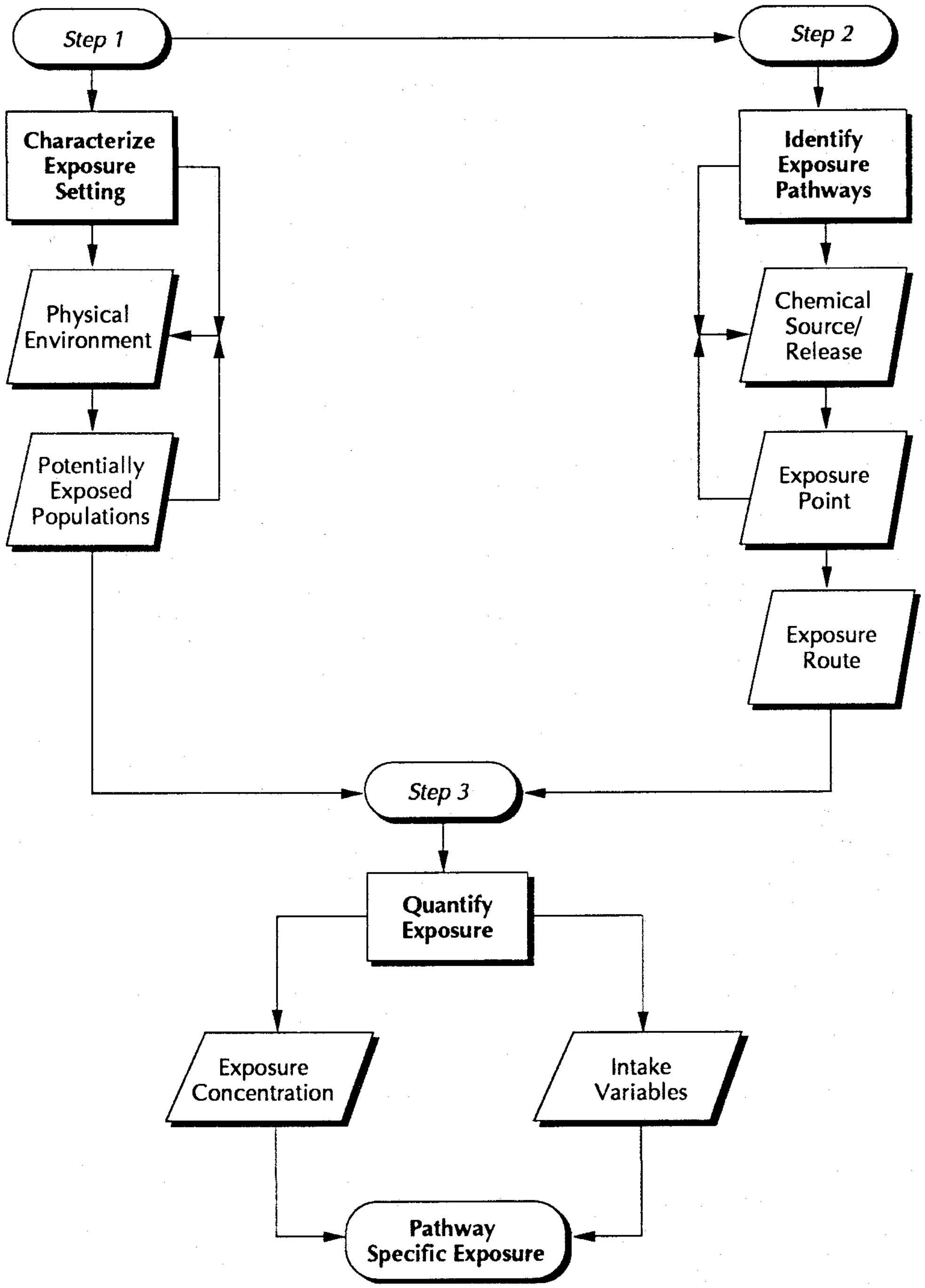

Figure 2 • Exposure Assessment Process

- Identify potential exposure pathways under current and future land use conditions;
- Develop exposure scenarios for each identified pathway and select those scenarios that are plausible;
- Identify scenarios assuming both existing and potential future uses;
- Identify the exposure parameters to be used in assessing the risk for all scenarios; and
- Develop an estimate of the expected exposure levels from the potential release of and/or exposure to contaminants.

Appropriate exposure scenarios will be identified for the site. Scenarios which could potentially be considered include residential, commercial/industrial, and/or recreational. Factors to be examined in the pathway and receptor identification process will include:

- Location of contaminant source;
- Local topography;
- Local meteorological data;
- Surrounding land use;
- Local water use;
- Prediction of contaminant migration; and
- Persistence and mobility of migrating contaminants.

For each migration pathway and for current and future conditions, receptors will be identified and characterized. Potential receptors will be defined by the appropriate exposure scenarios.

A technical memorandum will be submitted to EPA and the State for review and approval, describing the present, future, potential and reasonable use exposure scenarios with a description of the assumptions made and the use of data. This memorandum will be submitted prior to the required submittal of the Baseline Risk Assessment for the OU3, Other Outside Closures. In addition, a description of the fate and transport models that will be used, including a summary of the data that will be used with these models, will be submitted. Representative data will be utilized and the limitations, assumptions and uncertainties associated with the models will be documented (IAG, 1989).

Toxicity Assessment

Toxicity assessment, as part of the Superfund baseline risk assessment process considers (1) the types of adverse health or environmental effects associated with individual and multiple chemical and radiological exposures; (2) the relationship between magnitude of exposures and adverse effects; and (3) related uncertainties such as the weight of evidence for a contaminant's potential carcinogenicity in humans (EPA, 1988a).

EPA's interim final "Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual" (EPA, 1989a) provides detailed guidance on performing toxicity assessment for both chemical and radioactive contaminants. The steps of a toxicity assessment are shown in Figure 3. In accordance with EPA's risk assessment guidelines, the projected concentrations of contaminants of concern at exposure points will be compared with ARARs to judge the degree and extent of risk to public health and the environment (including plants, animals, and ecosystems). Because many ARARs do not exist for certain media (such as soils) nor are all ARARs necessarily health based, this comparison is not sufficient in itself to satisfy the requirements of the risk assessment process. Moreover, receptors may be exposed to contaminants from more than one medium. Nevertheless, the comparison with standards and criteria is useful in defining the exceedance of institutional requirements. Aside from the ARARs, the following criteria will be examined:

- Drinking water health advisories;
- Ambient water quality criteria for protection of human health;
- Center for Disease Control and Agency for Toxic Substances and Disease Registry soil advisories; and

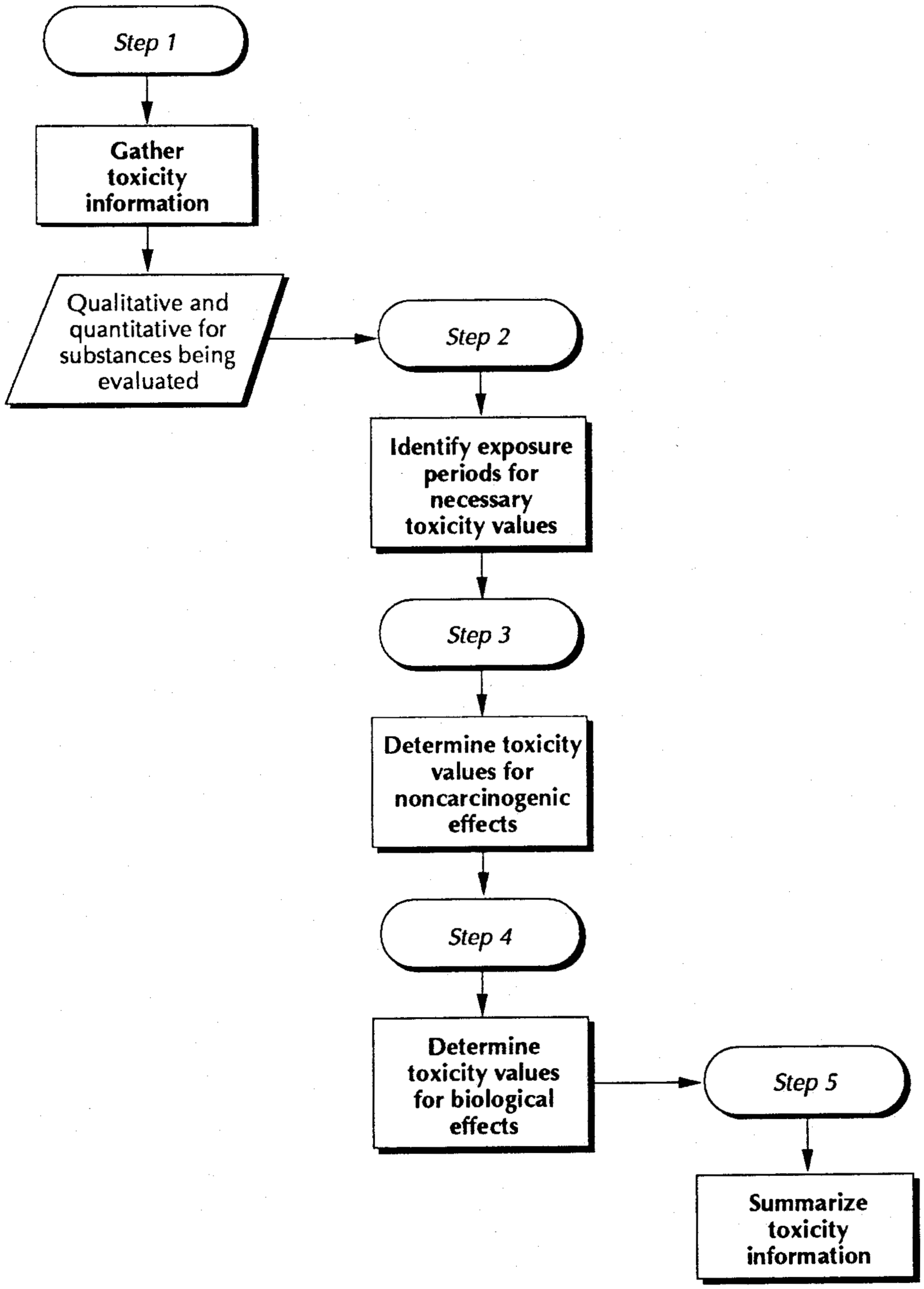

Figure 3 • Toxicity Assessment Process

- National Ambient Air Quality Standards.

Critical toxicity values (i.e., numerical values derived from dose-response information for individual compounds) will be used in conjunction with the intake determinations to characterize risk. Toxicity reference values from EPA's Integrated Risk Information System (IRIS) will be used in preference to other EPA reference values.

The baseline risk assessment will also include a summary of any toxicological studies performed for contaminants of concern. The quality of these studies and their usefulness in estimating human health risks will be described. A more detailed explanation of the toxic effects of target contaminants will be provided in the appendices to the human health risk assessment and the environmental evaluation. Toxicity reference values will also be summarized. For the human health risk assessment, this will include a brief description of the studies upon which selected reference values were based, the uncertainty factors used to calculate RfDs, and the EPA weight-of-evidence classification for carcinogens. For those chemicals without EPA toxicity reference values, a literature search, including computer data bases, will be conducted for selected compounds. A toxicity value will then, if possible, be derived from this information. For those substances lacking an EPA toxicity value for which DOE wishes to develop its own toxicity value, a technical memorandum will be submitted to the EPA and State for review and approval listing the toxicological and epidemiological studies that will be utilized to perform the toxicity assessment. This memorandum will be submitted prior to the required submittal of the Baseline Risk Assessment. All data utilized in the toxicity assessment will be validated and go through EPA and State review (IAG, 1989). Uncertainties regarding the toxicity assessment will also be discussed.

Two types of critical toxicity values will be used:

- the risk reference dose (rfd); and
- slope factor (for carcinogenic chemicals only).

Risk Characterization

Risk characterization involves integrating radiological and chemical exposure and toxicity assessment information to quantitatively and qualitatively estimate the risk of adverse health effects. Risk characterization will be performed in accordance with EPA guidance provided in "Interim Final Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (EPA, 1989a). The steps in the risk characterization are shown in Figure 4. A quantitative risk estimate will be performed for selected contaminants. To assess the potential adverse health effects associated with access to the site, the potential level of human exposure to the selected contaminants must be determined. Intakes (exposure level) of exposed populations will be calculated separately for all appropriate pathways of exposure to contaminants. Then for each population-at-risk, the total intake by each route of exposure will be calculated by adding the intakes from each pathway. Total oral, inhalation, and dermal exposures will be estimated separately. Because subchronic (i.e., two weeks to seven years) exposures to relatively high concentrations of contaminants may cause different non-carcinogenic effects than those caused by chronic (i.e., greater than seven years) exposures to lower concentrations, two intake levels will be calculated for non-carcinogens for each route of exposure to each contaminant, i.e., a subchronic daily intake (SDI) and a chronic daily intake (CDI). CDIs will be used for exposure to carcinogens. A reasonable maximum estimate of exposure (RME) based on the 95% upper confidence limit of the exposure data will be used where applicable. Risk will be quantified by comparison of contaminant dose at exposure points to quantitative criteria for protection of human health.

An uncertainty analysis will be performed to identify and evaluate non-site and site specific factors that may produce uncertainty in the risk assessment, such as assumptions inherent in the development of toxicological endpoints (potency factors, reference doses). Moreover, site-specific factors which may produce uncertainty will also be discussed.

The results of the baseline risk assessment will be used to define and evaluate the remedial alternatives during the FS.

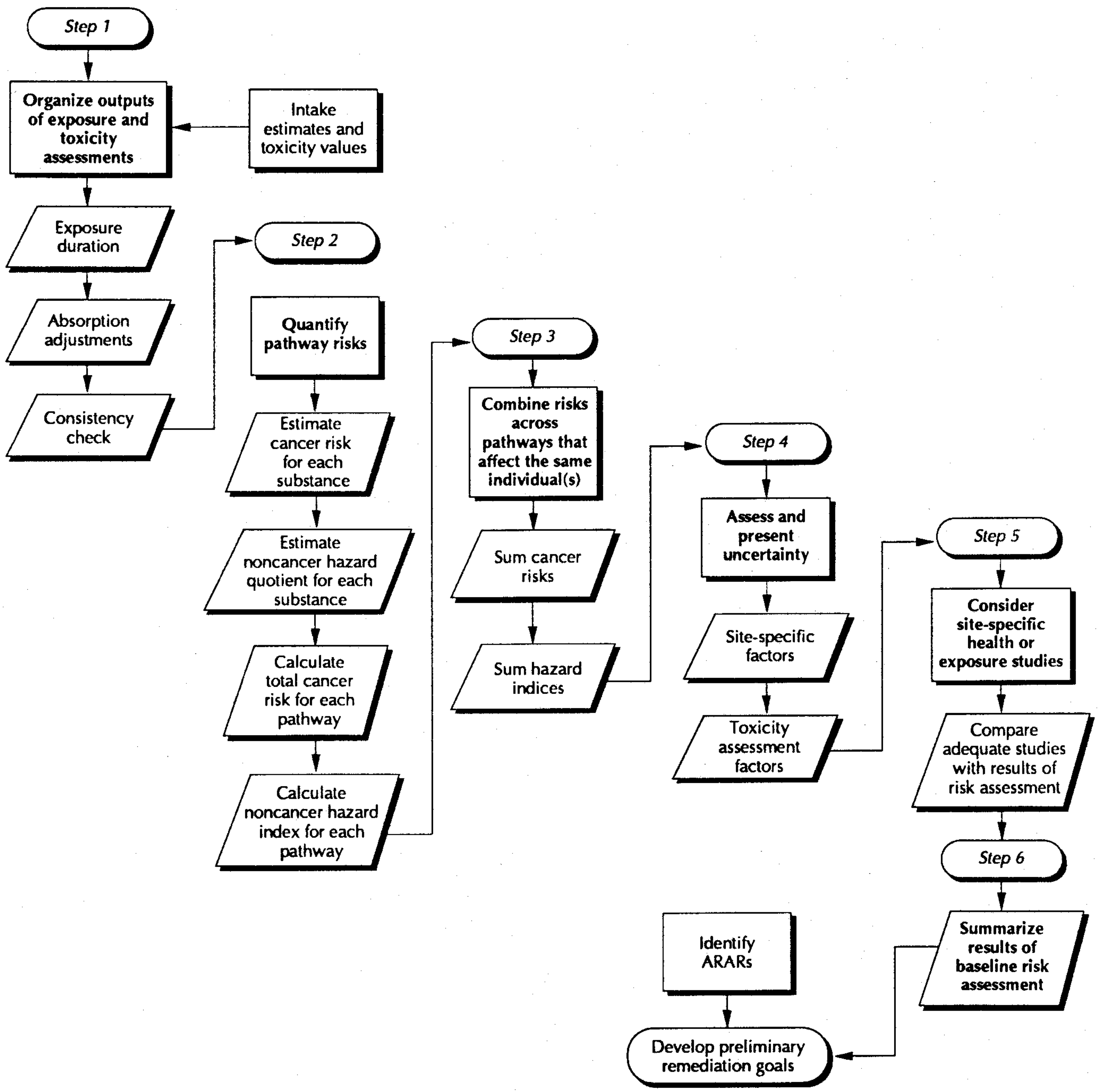

Figure 4 • Risk Characterization Process

REFERENCES

Environmental Protection Agency (EPA). 1989a. Interim Final Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual. EPA/540/1-89/002 (OSWER Directive 9285.7-01A).

Environmental Protection Agency (EPA). 1988a. Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA. Interim Final. EPA/540/G-89/004 (OSWER Directive 9355.3-01).

Environmental Protection Agency (EPA). 1988b. Proposed Guidelines for Exposure-related Measurements. 53 Federal Register 48830 (December 2, 1988).

Environmental Protection Agency (EPA). 1988c. Superfund Exposure Assessment Manual, Office of Emergency and Remedial Response. EPA/540/1-88/001. (OSWER Directive 9285.5-1).

Interagency Agreement between the U.S. DOE, the U.S. Environmental Protection Agency (EPA), and the State of Colorado, Attachment 2 - Rocky Flats Plant U.S. DOE Federal Facility Agreement Statement of Work, December 8, 1989 (IAG, 1989).

U.S. Environmental Protection Agency (EPA). 1980. Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans. QAMS-005/80. Reissued 1983 as EPA-600/4-83-004.

APPENDIX I
SUGGESTED OUTLINE FOR A BASELINE RISK ASSESSMENT REPORT

1.0 INTRODUCTION

1.1 Overview
- ·General problem at site
- ·Site-specific objectives of risk assessment

1.2 Site Background
- ·Site description
- ·Map of site
- ·General history
  - -- Ownership
  - -- Operations
  - -- Contamination
- ·Significant site reference points
- ·Geographic location relative to offsite areas of interest
- ·General sampling locations and media

1.3 Scope of Risk Assessment
- ·Complexity of assessment and rationale
- ·Overview of study design

1.4 Organization of Risk Assessment Report

2.0 IDENTIFICATION OF CONTAMINANTS OF POTENTIAL CONCERN

2.1 General Site-specific Data Collection Considerations
- ·Detailed historical information relevant to data collection
- ·Preliminary identification of potential human exposure
- ·Modeling parameter needs
- ·Background sampling
- ·Sampling/Survey locations and media
- ·Sampling/Survey methods
- ·QA/QC methods
- ·Special analytical services (SAS)

SUGGESTED OUTLINE FOR A BASELINE RISK ASSESSMENT REPORT (Continued)

- ·Potentially Exposed Populations
  - -- Relative locations of populations with respect to site
  - -- Current land use
  - -- Potential alternate future land uses
  - -- Subpopulations of potential concern

3.2 Identification of Exposure Pathways
- ·Sources and receiving media
- ·Fate and transport in release media
- ·Exposure points and exposure routes
- ·Integration of sources, releases, fate and transport mechanisms, exposure points, and exposure routes into complete exposure pathways
- ·Summary of exposure pathways to be quantified in this assessment

3.3 Quantification of Exposure
- ·Exposure levels and concentrations
- ·Estimation of doses for individual pathways

3.4 Identification of Uncertainties
- ·Current and future land-use
- ·Environmental sampling and analysis
- ·Exposure pathways evaluated
- ·Fate and transport modeling
- ·Parameter values

3.5 Summary of Exposure Assessment

4.0 TOXICITY ASSESSMENT

4.1 Toxicity Information for Noncarcinogenic Effects
- Appropriate exposure periods for toxicity values
- Up-to-date RfDs for all chemicals
- One- and ten-day health advisories for shorter-term oral exposures
- Overall data base and the critical study on which the toxicity value is based (including the critical effect and the uncertainty and modifying factors used in the calculation)
- Effects that may appear at doses higher than those required to elicit the critical effect
- Absorption efficiency considered

4.2 Toxicity Information for Carcinogenic Effects
- Exposure averaged over a lifetime
- Up-to-date slope factors for all carcinogens
- Weight-of-evidence classification for all carcinogens
- Type of cancer for a Class A carcinogens
- Concentration above which the dose-response curve is no longer linear

4.3 Chemicals for Which No EPA Toxicity Values Are Available
- Review by ECAO
- Qualitative evaluation
- Documentation/justification of any new toxicity values developed

4.4 Uncertainties Related to Toxicity Information
- Quality of the individual studies
- Completeness of the overall data base

4.5 Summary of Toxicity Information

5.0 RISK CHARACTERIZATION

5.1 Current Land-use Conditions

- Carcinogenic risk of individual substances
- Chronic hazard quotient calculation (individual substances)
- Subchronic hazard quotient calculation (individual substances)
- Shorter-term hazard quotient calculation (individual substances)
- Carcinogenic risk (multiple substances)
- Chronic hazard index (multiple substances)
- Subchronic hazard index (multiple substances)
- Shorter-term hazard index calculation (multiple substances)
- Segregation of hazard indices
- Justification for combining risks across pathways
- Noncarcinogenic hazard index (multiple pathways)
- Carcinogenic risk (multiple pathways)

5.2 Future Land-use Conditions

- Carcinogenic risk of individual substances
- Chronic hazard quotient calculation (individual substances)
- Subchronic hazard quotient calculation (individual substances)
- Carcinogenic risk (multiple substances)
- Chronic hazard index (multiple substances)
- Subchronic hazard index (multiple substances)
- Segregation of hazard indices
- Justification for combining risks across pathways
- Noncarcinogenic hazard index (multiple pathways)
- Carcinogenic risk (multiple pathways)

5.3 Uncertainties
- Site-specific uncertainty factors
  - -- Definition of physical setting
  - -- Model applicability and assumptions
  - -- Parameter values for fate/transport and exposure calculations
- Summary of toxicity assessment uncertainty
  - -- Identification of potential health effects
  - -- Derivation of toxicity value
  - -- Potential for synergistic or antagonistic interactions
  - -- Uncertainty in evaluating less-than-lifetime exposures

5.4 Comparison of Risk Characterization Results to Human Studies
- ATSDR health assessment
- Site-specific health studies (pilot studies or epidemiological studies)
- Incorporation of studies into the overall risk characterization

5.5 Summary Discussion and Tabulation of the Risk Characterization
- Key site-related contaminants and key exposure pathways identified
- Types of health risk of concern
- Level of confidence in the quantitative information used to estimate risk
- Presentation of qualitative information on toxicity
- Confidence in the key exposure estimates for the key exposure pathways
- Magnitude of the carcinogenic and noncarcinogenic risk estimates
- Major factors driving risk
- Major factors contributing to uncertainty
- Exposed population characteristics
- Comparison with site-specific health studies

6.0 SUMMARY

6.1 Contaminants of Potential Concern

6.2 Exposure Assessment

6.3 Toxicity Assessment

6.4 Risk Characterization

APPENDIX C

ENVIRONMENTAL EVALUATION PLAN (EEP)

Environmental Evaluation

An environmental evaluation (ecological assessment) may be conducted to :

° Document actual or potential threat of damage to the environment, in support of a proposed removal action;

° Define the extent of contamination;

° Determine the actual or potential effects of contaminants on protected wildlife species, habitats, or special environments;

° Document actual or potential adverse ecological effects of contaminants, as part of a Remedial Investigation;

° Develop remediation criteria; and

° Evaluate the ecological effects of remedial alternatives, as part of a Feasibility Study.

A given assessment may entail one or more of these objectives as the primary reason(s) for the study (EPA, 1989a). The objective of the environmental evaluation for Operable Unit (OU) No. 3, Other Outside Closures is to determine if contaminants potentially present have caused or are causing any adverse environmental impact. The data to be collected will be utilized in conjunction with existing data to determine the bio-availability and toxicity of the contaminants to the flora and fauna. Environmental sampling and analysis will be conducted in accordance with a Quality Assurance Project Plan addressing EPA QAMS-005/80, "Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans" (EPA, 1980).

The environmental evaluation will be conducted per guidance provided in the "Risk Assessment Guidance for Superfund, Volume II, Environmental Evaluation Manual" (EPA, 1989a) as part of the OU3, Other Outside Closures Phase II RFI/RI. The scope of the investigation will include the collection of vegetation, small mammals, arthropods, and aquatic life for determining if bio-accumulation is occurring, where applicable. The radioecology study, "Rocky Flats Plant Radioecology and Airborne Pathway Summary Report" (Rockwell, 1986), the "Final Environmental Impact Statement" (U.S. DOE, 1980), the soils and surface water chemical data, and biological parameters collected during this environmental evaluation will be utilized to assess both the current and future impacts from OU3, Other Outside Closures.

Field and laboratory activities will be necessary to determine what effect contaminants at the OU3, Other Outside Closures are having on the area's flora and fauna. These activities may include field assessments, toxicity testing, and biomarkers.

Aquatic and terrestrial field surveys will provide detailed assessments of ecological effects. A field survey for aquatic invertebrates in South Walnut Creek will be conducted in order to determine if these organisms have been adversely affected by contaminants at this site. The survey will include relative abundance, species richness, community organization, and biomass. The upper reaches of North Walnut Creek will serve as a "control" for comparison with results from the South Walnut Creek survey.

Toxicity tests will be conducted for the aquatic systems if the aquatic survey indicates an impact. The toxicity of environmental media can be estimated using two approaches: a chemistry-based approach or toxicity-based approach. The chemistry-based approach will first be applied where chemical analyses of water, air, soil, or sediment will be compared to literature criteria to estimate toxicity. If this analysis fails to explain the contaminant impact on the biota, the toxicity-based approach involves the measurements of a biological effect associated with exposure to complex mixtures. For this study, toxicity testing will include acute and chronic toxicity methods for aqueous samples.

The concept of biomarkers is that selected endpoints (such as population-ecosystem density, diversity, or nutrient cycling) which are measured in individual organisms are typically comprised of biochemical or physiological responses that can provide sensitive indices of exposure of sublethal stress. Additionally, the biomarker approach has considerable potential for assisting with human health hazard assessments, where individual organism responses are of great concern. In this context, animals inhabiting waste sites, or exposed to waste site media, can serve as sentinels for health effects in humans (EPA, 1989b). The most direct biomarker to assess exposure is to measure tissue residues which is a key component of bio-accumulation. Biomarkers for sublethal stress include histopathology, determination of skeletal abnormalities, measurement of gas exchange in plants and other various measurements (i.e., enzymes). For this evaluation, toxicological endpoints for indicator or target species will be chosen based on a review of available laboratory toxicity tests providing quantitative data for species of concern, when available. In the absence of toxicological indices for the target species, toxicological endpoints will be derived using safety factors that reflect interspecies extrapolation, acute-to-chronic extrapolations, and added protection for endangered and/or threatened species. Procedures to be used for the field and laboratory activities are presented in the "Ecological Assessment of Hazardous Waste Sites: A Field and Laboratory Reference" (U.S. EPA, 1989b).

In presenting the conclusions of the environmental evaluation for OU3, Other Outside Closures, the degree of success in meeting the overall objective of the evaluation will be discussed. The evaluation will:

° Identify all significant receptor populations;
° Portray all relevant routes of exposure;
° Characterize all significant ecological threats; and
° Describe uncertainties in the evaluation process.

Each conclusion will be presented along with items of evidence which would support or fail to support the conclusions and the uncertainty accompanying that conclusion. Any factors that limited or prevented development of definitive conclusions will also be described. Information will be provided to indicate the degree of confidence in the data that was used to assess the site and its contaminants.

As specified in EPA's "Interim Final Risk Assessment Guidance for Superfund, Volume II: Environmental Evaluation Manual" (EPA, 1989a), the environmental evaluation report will be written using the following outline:

° Objectives of Assessment

- Scope of Investigation
- Site and Study Area
- Contaminants of Concern
- Characterization of Exposure
- Characterization of Risk or Threat
- Derivation of Remediation Criteria
- Conclusions and Limitations to the Analysis

REFERENCES

Environmental Protection Agency (EPA). 1989a. Interim Final Risk Assessment Guidance for Superfund, Volume II: Environmental Evaluation Manual. EPA/540/1-89/001 (OSWER Directive 9285.7-01).

Environmental Protection Agency (EPA). 1989b. Ecological Assessment of Hazardous Waste Sites; A Field and Laboratory Reference. Office of Research and Development - Corvallis Environmental Research Laboratory. EPA/600/3-89/013.

Interagency Agreement between the U.S. DOE, the U.S. Environmental Protection Agency (EPA), and the State of Colorado, Attachment 2 - Rocky Flats Plant U.S. DOE Federal Facility Agreement Statement of Work, December 8, 1989 (IAG, 1989).

Rockwell International (Rockwell). 1986. Rocky Flats Plant Radioecology and Airborne Pathway Summary Report.

U.S. Environmental Protection Agency (EPA). 1980. Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans. QAMS-005/80. Reissued 1983 as EPA-600/4-83-004.

U.S. Department of Energy (DOE). 1980. Final Environmental Impact Statement; Rocky Flats Plant Site, Golden, Jefferson County, Colorado. Final Statement to ERDA 1545-D, 3 Volumes.

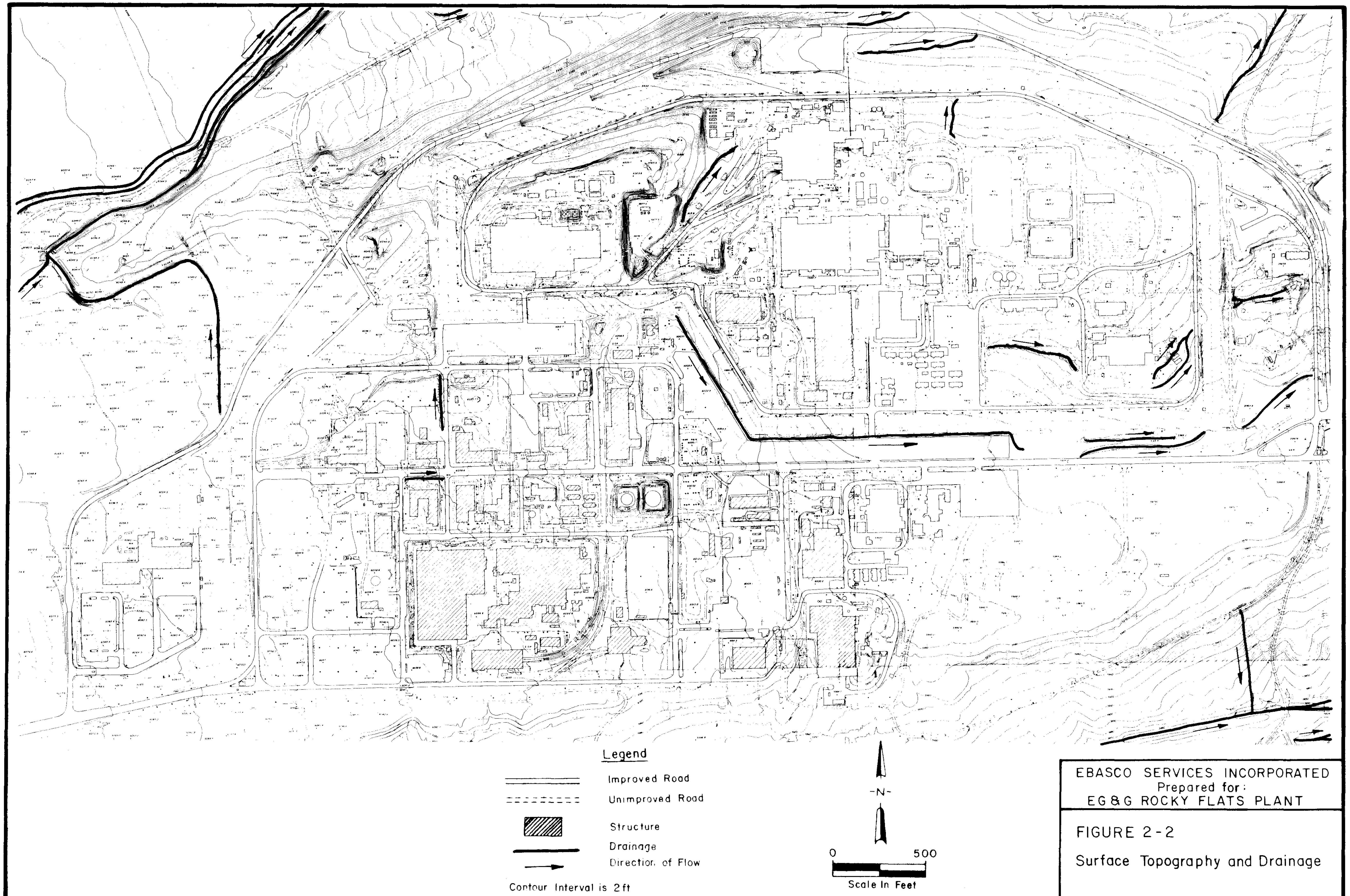

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FIGURE 2-2
Surface Topography and Drainage

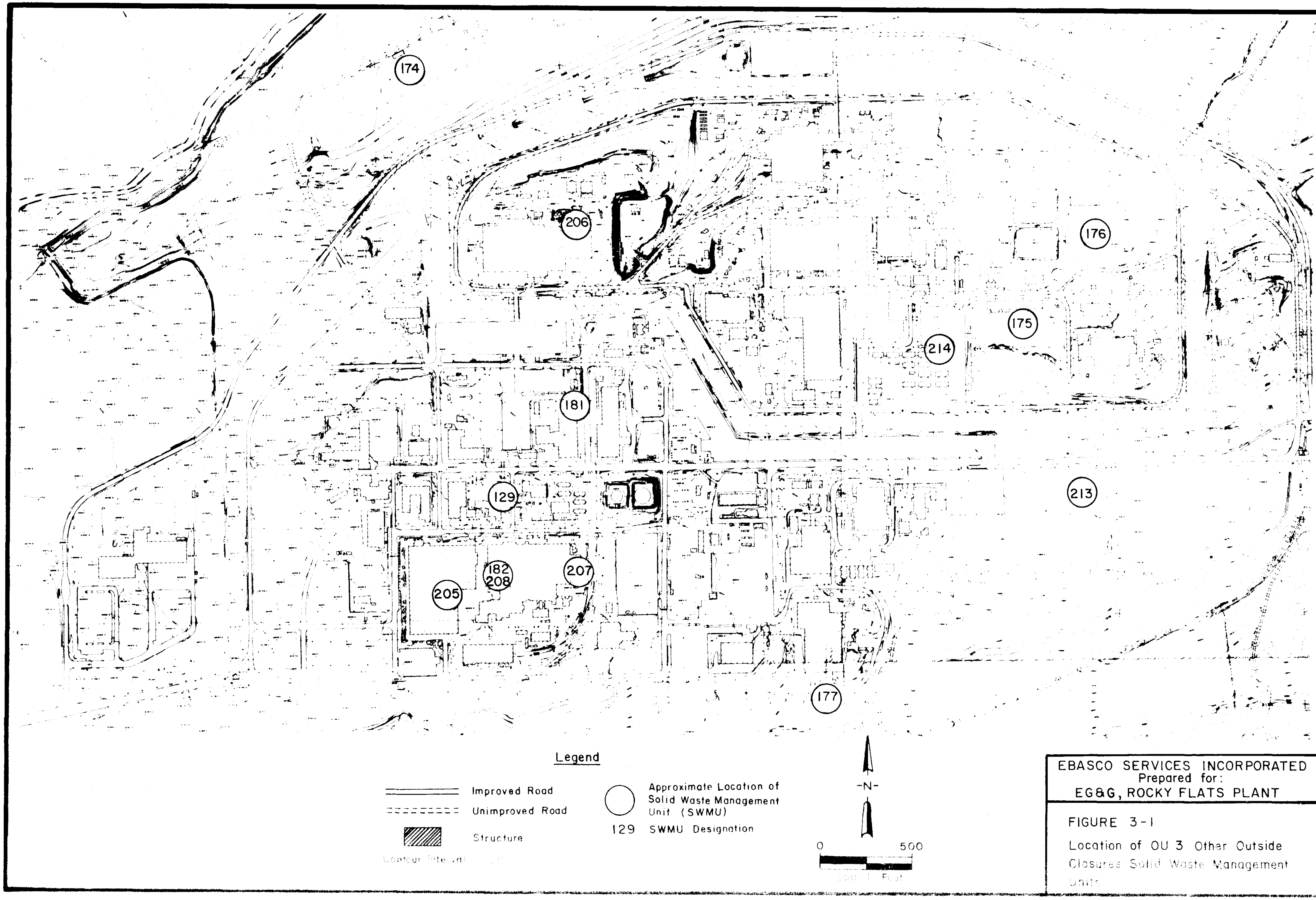

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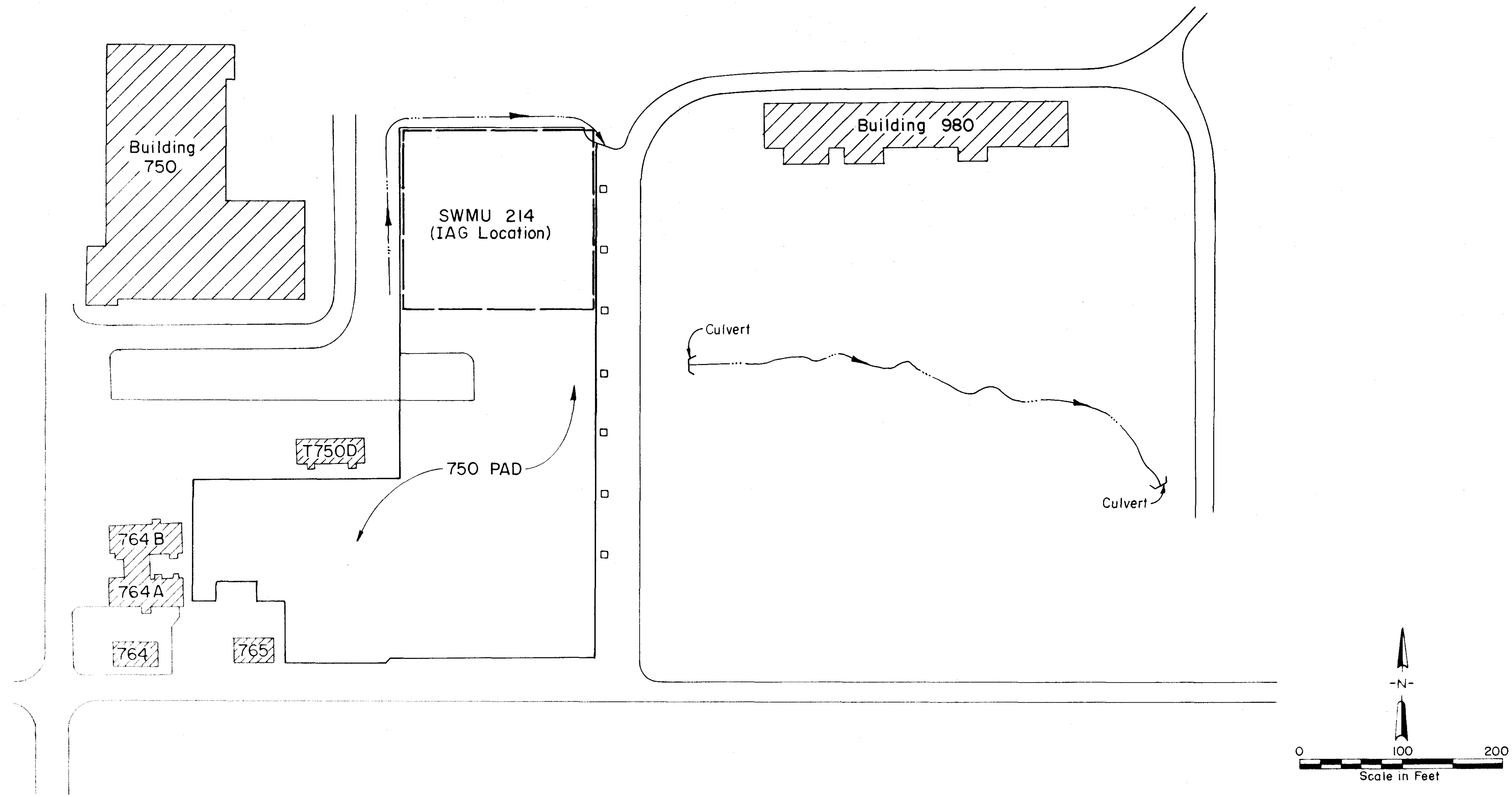
FIGURE 3-1
Location of OU 3 Other Outside Closures Solid Waste Management Units



Legend

Surface Drainage Indicating Direction of Flow

Drain

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FIGURE 3-13

Unit 25, 750 Pad Pondcrete and Saltcrete Storage (SWMU 214)

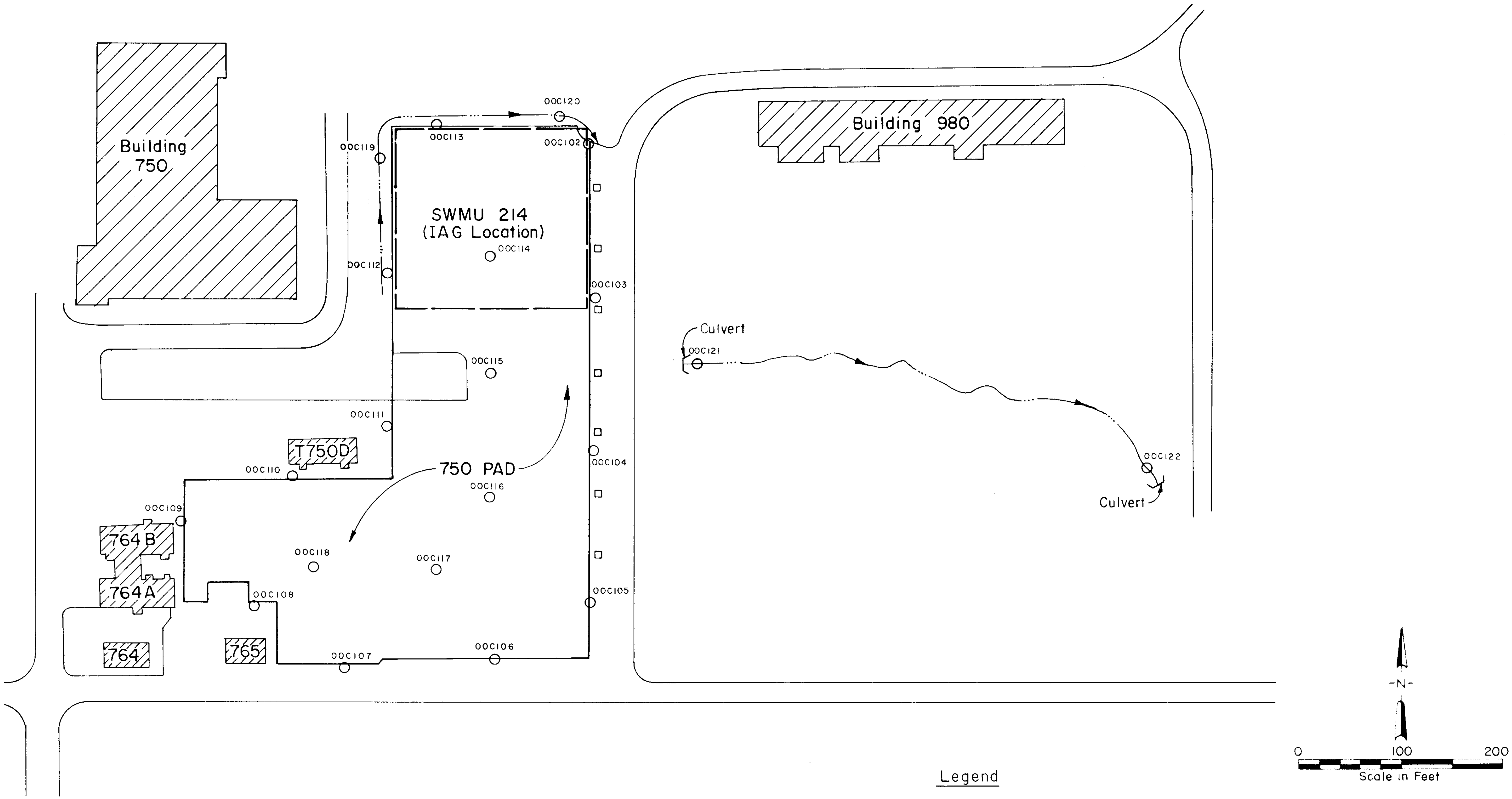

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FIGURE 2-11
Proposed Phase IA Sampling Locations for Unit 25, 750 Pad Pondcrete and Saltcrete Storage (SWMU 214)